

THURSDAY 27 JUNE 1968

Number 3094 Volume 93

Editor

J. M. RAMSDEN

Air Transport Editor

H. A. TAYLOR

Production Editor

ROY CASEY

Editorial Director

MAURICE A. SMITH DFC

Managing Director

H. N. PRIAULX MBE

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Iliffe Transport Publications Ltd, Dorset House, Stamford Street, London SE1; telephone 01-928 3333. Telegrams/Telex: Flight Iliffe, 25137 London. Annual subscriptions: Home £7 10s. Overseas £7 10s for one year; £19 for three years. Canada and USA \$19 for one year; \$49 for three years. Change of address—please note that four weeks' notice is required, together with the return of a wrapper bearing the old address. Registered at the General Post Office as a newspaper. Second Class Mail privileges authorised at New York, NY.

Branch Offices: Coventry, 8-10 Corporation Street; telephone Coventry 25210. Birmingham: 401 Lynton House, Walsall Road, Birmingham 22b; telephone 021 BIRchfield 4838. Manchester, 260 Deansgate, Manchester 3; telephone Blackfriars 4412 or Deansgate 3595. Glasgow, 123 Hope Street, Glasgow C2; telephone Central 1265-6. Bristol, 11 Marsh Street, Bristol 1; telephone Bristol 21491-2.

New York: Iliffe NTP Inc, 300 East 42nd Street, New York NY 10017, USA; telephone 867-3900.

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Britain First

There is still no doubt that the short-haul A-300 airbus, with one qualification, is technically the right formula. It is the sort of airbus that the European aircraft industry should be building. But it is the right aircraft being done in the wrong way—so wrongly, in fact, that the whole project is now on the point of collapse. European collaboration, which is intended to put European aircraft ahead of American competition, has effectively done for the A-300.

Britain was first with the airbus conception. The RAE's Short Haul Transport Aircraft Committee was formed more than seven years ago. Now Lockheed and Douglas are taking airbus orders. They have contracted to deliver certificated aircraft in 1971, fully a year before the first A-300 will be ready for roll-out. And Lockheed's launching cost is £150-£170 million, compared with the £220 million now estimated for the A-300. The European product is taking longer and costing more.

Ministers and their top advisers have been warned time and time again by leaders of the aircraft industry, by the technical aviation civil servants and by the leaders of the airlines that the A-300 was heading for trouble. But they have jogged along from one meeting to another, producing only talk and paper and rhetoric about collaboration. The European ideal is a splendid one, but it seems to have hypnotised the Government into forgetting that what matters is the right product at the right price and the right time.

One joint aircraft which could yet fulfil the European ideal is the Jaguar—essentially a one-country design which a second country applied to share. The A-300, involving three airframe contractors, three governments and three more or less commercially independent customers—is the wrong formula.

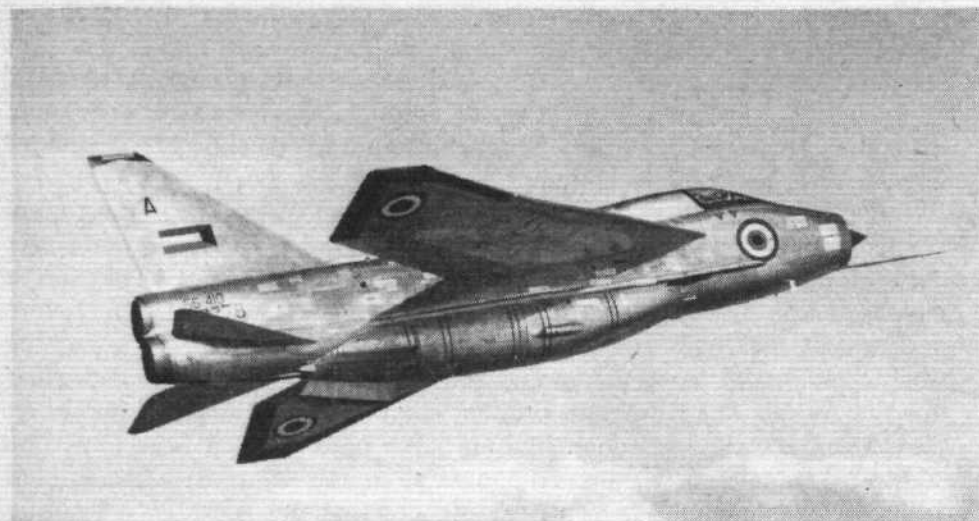
A-300 Realities

Where do we go from here? First we must face realities. Both Lufthansa and BEA have said many times now that they cannot commit themselves for several years; Air France and Air Inter have been more European-minded and have given encouragement to the project, but they have not made any firm commitments. Launching costs have rocketed—from £130 million two years ago to £220 million today, with a further likely heavy allowance for contingencies if fixed-price contracts are to be applied by the three governments (who are paying the entire bill). Rolls-Royce are now inevitably giving the RB.207, on which Mr Stonehouse insisted as the prerequisite of participation, lower priority than the RB.211 which they are building for the competing Lockheed 1011. Boeing now have a twin-JT9D short-haul airbus project, and both Douglas and Lockheed are looking at versions of their DC-10 and 1011 in the short-haul A-300 category. There must now be even greater doubts about France's capacity to lead the A-300 project and to control the expenditure of £80 million of British taxpayer's money. And, finally, there is the one technical qualification, which is the unwise wisdom of total reliance on the twin-jet formula. There have been many successful twin-jet airliners, but none as heavily populated and as asymmetric as the A-300. It could be a trijet if the APU engine were designed for propulsion as well as for systems power.

The A-300 cannot now succeed as at present devised, and it will have to be abandoned. The time has come to put Britain first. It is not too late for Hatfield to start work on a twin-RB.211 mini-airbus with 200 seats, with the wide body which will be mandatory from the 70s, with a truly short-haul maximum-payload range of 500 miles—matching all but two or three of the world's 20 busiest routes—and with an integrated systems/propulsion engine. European collaboration will follow, as it did with Jaguar.



WORLD NEWS



Two-gun twin The first BAC Lightning for Kuwait has now begun flight testing at Warton. The aircraft is a Mk 55 two-seat version of the multi-role export Lightning and it is the first Lightning trainer to carry guns—two Aden 30mm cannon in the forward section of the ventral fuel tank. The aircraft can carry reconnaissance equipment, with a five-camera pack in place of its normal defensive missiles. Kuwait ordered Lightnings in December 1966. Delivery of Mk 53 single-seaters and Mk 55 two-seaters to Saudi Arabia are about to begin, and Kuwait deliveries start later this year.

Demise of the F-228

The decision not to proceed with the Fairchild Hiller F-228 was announced at the weekend; instead, the company will market and support the European-built Fokker F.28 Fellowship and any future versions of the type in the USA, Canada and Mexico, and as a start has placed an order for ten.

The reason for the F-228 cancellation includes the fact that recent design changes have brought it much closer to the F.28. The latter, which is now nearing completion of its certification programme, is more than a year ahead of the F-228. Moreover, the field performance of the F.28 has been found during flight tests to be better than anticipated.

The F.28 consortium—Fokker, HFB, VFW and Short Bros & Harland—and Fairchild Hiller have agreed that the development of the F.228 is now unnecessary.

Any doubts about the future of the Rolls-Royce Trent, now being developed for the F-228, were countered on Monday by a statement from the company that, although there would now be no initial version of the Trent, the Trent programme would continue. A modified version was being offered to manufacturers in the UK, Japan, Sweden and the USA, and there was also the possibility that the engine would be used in a follow-on version of the Fellowship. In the meantime the F-228 cancellation would give rise to improved sales prospects for Spey Juniors to power the F.28. Rolls-Royce also said that the

financial effects of the F-228 cancellation were not expected to be great; no contribution to profits from the engine had been expected before 1970.

F-111 Cancellation Costs

Britain's cancellation of her F-111 order is expected to cost \$259 million (£108 million), a UPI report from Washington said last week. This total is made up of a "penalty" of \$130 million (£54 million) for breach of contract and \$129 million (£54 million) in planned US offset purchases of British military equipment. In addition Britain will also lose US support in efforts to sell British military hardware to third countries, as in the case of Saudi Arabia. Neither British nor American sources approve the use of the word "penalty" to describe the settlement, which it is understood was reached at the beginning of May; however, this is what it amounts to. From the British point of view, it is a fair arrangement and "about what was expected." It is not beyond suspicion that the US Government is making cancellation a very expensive exercise for Britain in an attempt to dissuade Australia from doing likewise. Dismayed by the upward spiralling of the cost of 24 F-111Cs ordered for the RAAF—latest estimate is \$A250 million (£116.5 million)—the Australian Government has just learned that delivery has been delayed, for modifications in the light of recent F-111A crashes. The first aircraft will be handed over in the US at the end of August, reports Radio Australia.

Airbus Gloom

Sparked off by yet another statement by Lufthansa that no aircraft of airbus size would be needed before 1975 at the earliest (see last week's issue, page 918), the reactions of the British Press have been almost unanimously gloomy about present prospects of the European A.300. Headlines included statements such as "Airbus may be scrapped for lack of orders" and "Hatchet poised over Airbus." The Lufthansa statement, this time by Dr Herbert Culmann, the financial director, followed an "invitation" to the airline from the German Government to order ten A.300s and take an option on eight more. He is reported as saying that Lufthansa (which is 75 per cent State-owned) would "ignore" the request.

Later a spokesman for the German Government reacted to the reports that the Airbus might be scrapped at next month's Ministerial meeting, describing them as "deliberately inspired" and adding that the Federal Government was as firmly committed as ever to the project and believed in its success. He said that it had long been known that Lufthansa did not want the Airbus before 1975, but the important thing was that the airline should place orders before that date.

As we went to press with this issue the next tripartite ministerial meeting on the Airbus was still due to be held as planned in July. Asked whether a go-ahead was still—as restated at the Hanover Show by Mr John Stonehouse, Minister of State, Technology—"on the basis of firm commitments by the three airlines," a Ministry of Technology spokesman said last Monday that there was, so far, no change in the policy.

Lockheed Commercial Transport Plans

Lockheed are making a determined bid to re-establish themselves in the civil air transport field. Announcing this at Burbank last week, the chairman of Lockheed Aircraft, Mr Daniel J. Haughton, said: "We're trying to stake out a lot of territory in this field. We are going back in, as hard and as fast as judgment allows, and we are going to do it with three types of aircraft—the 1011, the L.500, and rotary-wing compound helicopter VTOL aircraft."

On the latter—"the marriage of the helicopter and the aircraft"—Mr Haughton said: "I can't think why we didn't do it years ago—unless it was the cost of \$50 million." It was hoped to launch the project in late 1969 or 1970. Mr A. Carl Kotchian, president of the Lockheed corporation, said that the world needed what he called "doorknob to doorknob" VTOL.

Mr Haughton said that although Lockheed had been eliminated from the SST competition, he felt very strongly that

the SST was something the United States had to have, and hopefully Lockheed might come back into the business.

Looking even further ahead, the company's chief scientist, Dr Roy Smelt (British-born, ex-RAE), was stated to be studying a nuclear-powered aircraft—"though it will be sometime yet before we walk round a reactor to get into our seats."

Force de Frappe Delay?

France's foreign minister, M Michel Debre, said recently that the country's industrial troubles might force President de Gaulle to cut back on the airborne nuclear striking force, the Force de Frappe. The programme might be set back by as much as one or two years.

Rolls-Royce's Good Year

A profit of £7,476,583 after taxation—an increase of some 42 per cent over that of the previous year—was made by Rolls-Royce in 1967, according to the chairman, Lord Kindersley, in his report to the annual general meeting (on July 16). The gross trading revenue was £266 million, of which exports to North America and Europe accounted for £40 million and £29 million respectively. The aero engine division of Rolls-Royce and Bristol Siddeley contributed 80 per cent of the total sales and 83 per cent of profits before interest and taxation.

Lord Kindersley said that more money was now required to finance the company's capital needs. No sum was stated but it is believed that about £20 million will be needed for what he called "a substantial funding operation which will take into account the continuing high level of capital invested."

Three new engines were run in 1967: the RB.172/T260 Adour, the three-spool Trent (see Demise of the FH.228, page 942) and the TF.41 turbofan engine. Production of the Spey engine had built up: further developments for the One-Eleven and Trident would prolong the commercial attraction of this engine until the advanced technology engines became available. Referring to the Spey variant for the Phantom, Lord Kindersley said that the various problems associated with the engine were well on the way towards resolution. He congratulated Sir David Huddie, who led the

sales campaign on the RB.211 engine in America, and said that the securing of the order was the major benefit of the merger with Bristol Siddeley Engines.

Lord Kindersley said that orders worth £360 million were outstanding at the beginning of the year and that a great effort was being made to benefit from the effects of devaluation. But he warned that this measure would have an adverse effect on costs and an even higher productivity would be necessary to remain competitive; nevertheless, with the present foreseen level of business, higher profits were forecast for 1968.

UK Business Aircraft Orders

This is the Business Aircraft special issue of *Flight* (see pages 956-971) and, fortuitously, the Society of British Aerospace Companies has just issued figures for sales of British aircraft in this category. Largest sales (£40 million to date) are for the Handley Page Jetstream, totalling 176—100 ordered in Europe, the Middle East and Africa, 76 in the USA. Sale of the 150th Hawker Siddeley 125 had recently been announced; of this total 119 are for export, worth over £29 million. The Britten-Norman Islander order book, more than 95 per cent of it for export, is now worth over £6½ million: a total of 236 is due to be built by the end of next year. There are orders and firm enquiries for 20 Beagle 206s, in addition to the 53 so far delivered, 19 of them to export customers.

Air League's AERO Scheme

"There is no redeeming feature in the catalogue of cancellations and broken promises," says the Air League in its annual report for 1967-68, referring to the cancellations of the AFVG and the F-111 order and the decision to cut the number of Phantoms allocated to the Royal Navy. The League says that its Council "regard it as one of their most important tasks to do everything in their power to publicise the dangers of the defence policies which are now in force."

Referring to its educational activities, the League says that a new development, "which it is hoped may ultimately lead to a large expansion in air education in schools and colleges all over the UK, is now being examined." Considerable progress has already been made and first

SENSOR

Boeing's airbus, the so-called 757, is now almost certain to be a 2½-engined design with the APU doubling up as a propulsion unit to provide "trijet capacity." The most likely candidate, and the subject of current joint work, is the Rolls-Royce Trent. One of the most important probable developments is the engineering of the intake to suck off fuselage boundary layer, reducing drag of the wide body by about 15 per cent.

The next four potential customers for the Lockheed 1011 or DC-10 are Northwest (likely to sign for up to 20 within the next month), Braniff with up to 12, and Continental and National with about six each.

Lockheed is unlikely to re-enter the American SST competition with its fixed-wing delta but the company's advanced project team is active on a new design. The company believes it has found a way of shaping a supersonic aeroplane for minimum boom. Lockheed is, however, unlikely to commit itself to any design until the Concorde's booms have been evaluated.

Although Rolls-Royce would obviously supply RB.211s for any DC-10 customers who might specify them, the engine company is more than content to have its loyalty to Lockheed and the 1011 clearly defined and uncomplicated. Rolls-Royce is not in fact active on the DC-10.

The first RB.211 will run on the test bed at Rolls-Royce on September 1. There will be 12 engines engaged in the bench development programme. Altitude-testing will start in April 1969 at NGTE, and flight development will begin in a VC10 (with two Conways replaced by one RB.211) in January 1970, lasting until December 1970. The 211 will be ready for revenue service in the Lockheed 1011 in November 1971.

Negotiations are well advanced with the Government of the Congo (Kinshasa) for the sale of ten Short Skyvans for operations probably in Air Congo colours. Financing the deal is the main difficulty.

Aer Lingus are thinking of setting aside the upper passenger deck area of their 747s as a nursery and play area for children.

Shorts' Blowpipe man-portable anti-aircraft missile proves to have good anti-tank qualities too. With a 4lb warhead (the US rival Redeye has only ½lb of explosive) Blowpipe has successfully pierced 5in of armour plate on tests.

Boeing's SST project is still in serious weight difficulties. Some estimates put the weight of the variable-geometry wing-hinge as high as 18,000lb per hinge. The additional weight penalty of the tailplane-mounted engines, both drag and weight, are combining with the weight of the hinges to eliminate payload.

USAF DC-9 First military use of the McDonnell Douglas DC-9 twin-jet airliner comes with the C-9A aeromedical development of the DC-9 Series 30 commercial aircraft. This first of twelve C-9As for the USAF's aeromedical service was rolled out at Long Beach this month and will be delivered in August. The C-9A will carry both walking and stretcher patients over ranges of up to 2,800 miles



WORLD NEWS...

steps taken towards the creation of a national air education and recreational organisation (AERO).

The League's annual general meeting is being held on Tuesday, July 9, at 3 p.m. at the Royal Aeronautical Society, 4 Hamilton Place, London W1.

Austria/US Gliding Champions

Final results of the International Gliding Championships at Leszno, Poland, which finished on June 23, give Austria as the winning country in the Open Class event, with America leading in the Standard Class. Winner of the former event was H. Wodl, flying a Cirrus, while the Standard Class champion is A. J. Smith, flying a Swiss-built Elfe. Britain's George Burton and Nicholas Goodhart finished 7th and 16th respectively in the Open Class, with John Williamson and David Innes 22nd and 30th in the Standard Class.

A full description of the concluding competition days will appear in *Flight* next week.

Tokyo Aerospace Show

Because of the great interest shown in it, the organisers state, the 1968 Tokyo Aerospace Show, originally planned to last for four days, has been extended to five. It will now open on Wednesday, October 9, and continue until Sunday, October 13. The organisers say that October 9 has been designated an Invitation day, "to give those profession-

ally, commercially and otherwise directly interested in the show a full opportunity of inspecting the exhibition and asking whatever questions they like."

It is being held at Iruma Air Self-Defence Force Base and the organisers' address is Tokyo Aerospace Show Office, c/o Asahi Shimbun, Chiyoda-ku, Tokyo.

"Tommy" Rose

We record with regret that Flt Lt "Tommy" Rose, DFC, who in 1935 won the King's Cup air race in a Miles Falcon Six and the following year set up a London-Cape Town solo record in the same aircraft, died last Thursday, June 20, in Alderney, CI, at the age of 73.

He served in the RFC and the RAF in the First World War, accounting for more than 12 enemy aircraft and winning the DFC; then after leaving the Service he flew all over the world as a commercial pilot. He had a long association with Philips & Powis Aircraft, who built many of F. G. Miles's designs, and later with Miles Aircraft. From 1947 to 1949 he was general manager of Universal Flying Services.

Twin-jet Hirondelle

A twin-jet version of the Hirondelle light twin-turboprop transport is being designed by Avions Dassault, reports our French contemporary *Air et Cosmos*. The Hirondelle, powered by two 800 h.p. Turbomeca Astazou 14s, is due to fly in September and is directly competitive with the Handley Page Jetstream. It is being offered in executive, light liaison and "commuter" airline versions.

The twin-jet development is designed

for either the P&W JT15-D engine or the new Turbomeca Larzac turboprop engine which was unveiled at the Hannover Show in April. To reduce modification from the original design to the minimum, the engines are housed in nacelles under and forward of the wing.

Capt W. E. Johns

We record with regret that Capt W. E. Johns, creator of the world-famous fictional aviation character "Biggles," died on Sunday, June 23, at the age of 75.

He served in the Royal Flying Corps, was shot down, twice escaped from POW imprisonment and was twice recaptured. He based some of the adventures of his fictional hero, Maj James Bigglesworth, whom he created in 1932, on his own First World War experiences.

Hatfield's Open Day

Members of the general public seldom have an opportunity of seeing the interior of an aircraft factory, but they will be able to do so on Saturday, July 13, when Hawker Siddeley, Hatfield, holds its annual open day. The works will be open from 9.30 a.m. until 1 p.m., and from 11 a.m. to noon there will be light-aircraft demonstrations. In the afternoon (when the works will be closed) there will be flying by larger military and civil aircraft. Admission is free, and there are no restrictions on photography. Hatfield is 21 miles north of London, and the works and airfield adjoin the A1.

Hawker Siddeley are kindly providing a marquee and refreshments for all members of the de Havilland Technical School Association and their families.

Parliament

One of the advantages of the House of Lords, much in the news last week because of the strength of its mobilisation over the Rhodesia sanctions issue, is that questions put to the Government by peers have a better chance of being answered than those put by MPs. Not only are there far fewer questions; their limited number gives more chance of a fuller reply. Thus when some aviation-minded peers wanted to ascertain (on Wednesday of last week, June 19) the effect of the French political troubles on the Concorde flight test programme, Lord Beswick was able to provide some considered answers.

Lord Trefgarne had raised this matter, asking the Government whether the French disturbances had "further de-

layed the first flight of the Concorde prototype being built at Toulouse; and whether, in view of those disturbances, plans ought not to be altered so that the Bristol-built prototype flies first."

Government spokesmen on this side of the Channel have always been careful to avoid any idea of a race between the two prototypes, and Lord Beswick played this fast ball with a very straight bat; while admitting that the French disturbances "seem bound to result in some further delay," he added firmly: "This is a joint programme, jointly reviewed, and all decisions are taken jointly in what is judged to be the best interests of the programme as a whole."

But Lord Trefgarne was not quite satisfied as to the situation at Toulouse. Had work restarted there? Would the delay to the prototype being built there be reflected on the one being built at Bristol? Was there any further delay in components to be used by BAC which were being made in Toulouse?

Components that were the cause of a delay prior to the disturbances, Lord Beswick explained, were manufactured neither in Toulouse nor Filton but were "a matter of sub contracting"; he understood that development work on them was virtually complete; the next stage

was to have them installed and the aircraft flight tested. His understanding was that work had restarted at Toulouse.

The idea of a race between 001 and 002 could not, however, be quite expelled from their lordships' minds; and Lord Selkirk wanted to know whether there was any truth in newspaper statements that some sort of competition existed between Filton and Toulouse regarding essential parts of the equipment of the respective aircraft.

Lord Beswick told him that an article had contained a statement that the BAC chairman had been trying to get components diverted from the French to the British prototype, so that the latter could fly before September. That statement was completely untrue; it would not be feasible to divert components in that way. He then added, in answer to another question from Lord Trefgarne, asking whether there might be a joint reappraisal of the prototype flight programme to see which aircraft could be prepared the more quickly: "There are, of course, regular meetings of the Concorde management board. I understand that the next meeting will be within the next few days. Almost certainly the programmes at Toulouse and Filton will be reviewed."



AIR TRANSPORT

Presenting the Lockheed airbus 1011 to: Mr M. C. Haddon, Lockheed Aircraft; Mr Daniel J. Haughton, chairman, Lockheed Aircraft; Sir David Huddle, managing director, Rolls-Royce Aero Engines Division; Mr Charles S. Wagner, president, Lockheed-California; Mr K. Bore, commercial engines, Rolls-Royce; Mr A. Carl Kotchian, president, Lockheed Aircraft; Mr Robert A. Bailey, project manager, 1011; Mr William M. Hannan, chief engineer, 1011



"Flight" photograph

PRESENTING THE 1011

By J. M. RAMSDEN

ENOUGH JOURNALISTS to fill two Lockheed 1011s, and certainly more than enough to crowd the mock-up, flew into Burbank from all over the world on June 18 for a presentation of the California company's new airbus. Co-sponsors of the show were Rolls-Royce, part of the strategy clearly being to present the RB.211 engine and all that lies behind it as not the least good reason for buying the aeroplane.

Top Lockheed and Rolls-Royce executives introduced their products with a degree of modesty appropriate to the occasion; questions were answered with unvarying frankness, though with a circumspection befitting the fact that the world is full of competitors and shareholders; and the mock-up was opened to reveal the new wide-body way to fly, with model-girl stewardesses of intimidating beauty, kitchen quarters in the basement, and plastic mock-ups of jumbo-sized shrimps which somebody said tasted better than the ones you get in real airliners these days.

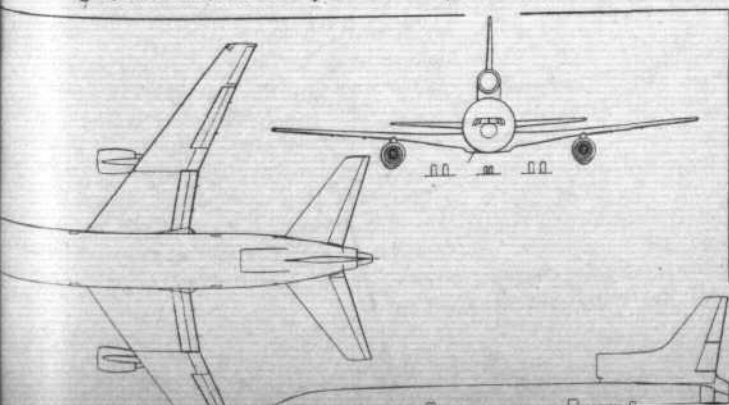
Next April, said Mr Charles S. Wagner, president of Lockheed-California, assembly would start in a new half-million sq ft area. The first aircraft would be ready for roll-out in September 1970; the first flight would be in November 1970;

and certification and first service would be in November 1971. He talked about the programme in terms of "events"—the most recent, earlier this month, having been the move from the preliminary to the project design phases. Another 200,000ft of engineering space, he said, with almost reckless precision, would be ready for occupancy on January 1.

Chairman of the board of the parent company, Lockheed Aircraft Corporation, Mr Daniel J. Haughton, said that the future of the air transport business was "like looking over the Grand Canyon—you can see it but you can't believe it." The new generation of big aircraft, which included their own C-5A as well as the 1011's competitors, the DC-10 and 747, would be more like ocean liners than flying tubes: "riding in these aeroplanes is going to be a brand new experience, and if there is a choice it is going to be hard to get people to ride in present-day aircraft." And these new aircraft were going to do more for air cargo than anything since the beginning of air cargo. Lockheed were going to fly the world's biggest aeroplane, the C-5A, this month "on the same day we said we would in October 1965." Even bigger than the C-5A would be the L.500 civil version, with a 2½-cent ton-mile cost. Maybe

This latest three-view is scaled for a wing span of 155ft 4in and a length of 177ft 2in. Wing area is 3,456 sq ft. Maximum fuselage stretch is 200ft. Right, not the interior of the mock-up, but a press presentation, Lockheed-style

"Flight" photograph





Top, individual lockers are provided for "hard-object" stowage; above, Lockheed have patented their underfloor galley, which makes room for about 28 revenue seats. Two stewardesses load the food carts with 54 meals per cart and send them up by two lifts to the cabin. The lifts can also carry one person each

AIR TRANSPORT...

they would decide on a go-ahead before the end of the year.

Mr Haughton said he was "very proud to be teamed up with Rolls-Royce." The 211 was the best engine available. "I have toured most of their works and met many of their people and I know this is going to be a long partnership." Both companies had world-wide support organisations, and together they would provide "a total capability."

Growth of the 1011, Mr Haughton explained, would be due to the growth of the engine. It was going to be an even more impressive aircraft when it had a range of over 3,500 n.m. "as we hope it will, perhaps by 1975." He did not know whether the European airbus was going ahead—"I have no reason to know one way or the other"—but if it did go ahead it would take some of the 1011's market. As if to underline the fact that the 1011 was already winning orders, Mr Haughton announced that Northeast had just increased their order from six to eight, bringing the total to 176 (Eastern, 50; TWA, 44; Air Holdings, 50; Delta, 24).

Next a British voice, in the Ulster accents of Sir David Huddie, managing director Rolls-Royce Aero Engines. "Development of the RB.211 is proceeding on schedule," he said, "and the first complete engine will run in September." Rolls-Royce had risked a lot of its own money on this programme, which had been under way since long before the

first orders were received. He went on to give facts and figures about the company; for example, that it had five types of turbine engine in service with 180 airlines and 64 armed services. He also mentioned a few of the Rolls-Royce firsts, such as the fan engine, air-cooled turbine blades, transatlantic jet service, and so on.

The unique feature of the 211, he explained, was that it was a three-shaft engine, which meant less weight and cost for a given performance. It enabled quieter approaches, thanks to the fan-throttle feature, and would be almost completely smoke-free. "You will hardly be able to see the smoke," he claimed. It would ensure that the 1011 was a "good neighbour aeroplane." It also had considerable growth capability—"we can see our way up to 50,000lb." Rolls-Royce were setting up special new 211 spares, repair, maintenance and customer-training facilities in the United States.

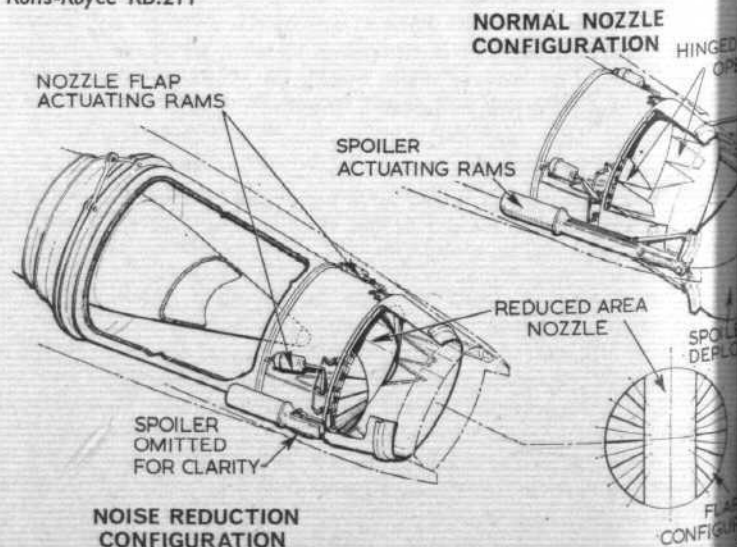
Mr Ken Bhole, Rolls-Royce project sales manager, believed he could say without contradiction that the 211 was the most technically advanced engine available today. The three-shaft layout meant 20-25 per cent fewer parts; this together with extensive use of new Rolls-Royce-developed composite materials produced an engine that was lighter, more robust, easier to maintain throughout its life, cheaper to buy, more responsive to the pilot, more economical, and quieter. Flaps in the main nozzle (see diagram) were, he explained, closed on the approach, making the high-pressure fan run faster and slowing down the fan and fan turbine. They had also done a "trick"—shaping the flap slot so that the noise escaped vertically. As those who had observed the Avon Caravelle and Spey One-Eleven would agree, Rolls engines were smokeless, and improved burners and fuel distribution would ensure that the 211 was also.

Mr Bhole made the point that Rolls-Royce were taking responsibility for the complete power package—thrust reversers, spoilers, pods and "all the bits and pieces, so that there will be no troublesome interface arguments, whereby the manufacturer can pass a problem on to somebody else."

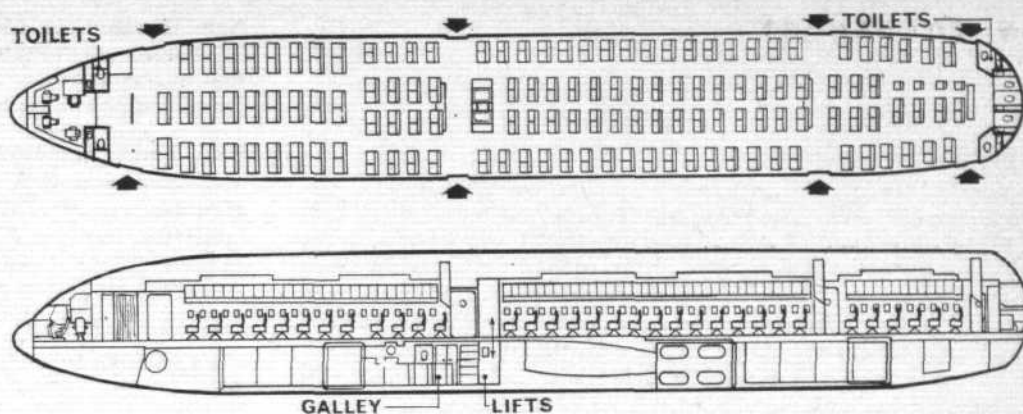
Mr Robert A. Bailey, 1011 project manager, described the aircraft as "big on the inside but small on the outside." Multiple doors would prevent the queueing and delays that passengers experienced in today's aeroplanes. All the mess of food preparation would be out of sight down below. There would be coat-storage at each seat and coat-storage overhead to provide more space for revenue seats. Polaroid windows could be adjusted to any light density, thus eliminating sticking blinds.

A "good-citizenship" aeroplane was also what the 1011 was going to be, said Mr Bailey. It would put out about half the noise of today's aeroplanes—107 PNdb at take-off compared with 118, and on the approach 107.9 compared with 120. Rolls-Royce had demonstrated many years ago that you could build a smokeless engine "and this is what they're going to do with the 211." As for the market, Mr Bailey saw 1,100 1011-type aeroplanes needed by 1980, of which 325

First drawings of the fan-throttling noise-abatement flaps of the Rolls-Royce RB.211



Main cabin floor area is 2,345 sq ft, and passenger capacity is 250-345 depending on seat pitch (all seats two-by-two). Baggage and cargo volume is 3,400 cu ft. Initial design gross weight is 409,000lb, operating weight 225,500lb, and max payload nearly 88,000lb



would be in Europe ("England, France and Germany formed a consortium to study the feasibility of constructing such a new air transport," said a Lockheed handout, "and the European airlines also are now examining the Lockheed L-1011.")

Questions and answers

Were Lockheed contemplating a QC version? Not at the moment, a Lockheed man replied, but perhaps eventually. Had flight instrumentation been decided? It was a little early so say yet. Had the 90sec FAA evacuation time been demonstrated? Not yet, but it would be; the cabin had been designed to meet all FAA requirements and there were eight doors. Was transatlantic capability planned? Yes, the aircraft would grow eventually to 4,500 n.m.

Was there going to be a name for the 1011, in the Lockheed star tradition? Mr Haughton replied: "We haven't picked a name yet, but we'll have to do so one day for this luxurious aeroplane, if only to get away from the name airbus. But if we sell enough we'll be happy to call it an airbus."

How about Air Force interest? Yes, but nothing specific. How did the first flight date compare with that of the DC-10? Pretty close. How could a third shaft mean fewer engine parts? "You get more work per stage," replied Sir David Huddie. What would the overhaul life be? This was a concept that had almost gone, said Sir David. The 211 was designed in modules, any one of which could be replaced on-wing. Would there be any assembly of the RB.211 in the USA? No, the engines would be built in Derby.

What exactly would be the role played by Air Holdings? Mr Haughton replied: "Air Holdings have a firm contract for 30 aircraft. The Air Holdings aircraft will be the first 1011s sold outside the USA whether we or Air Holdings sell them. There have been questions about whether this is a firm contract. I can say that it definitely is. The deposit money is in the bank. People can speculate. You are a fine audience and you wouldn't do such a thing, but in case others do I would like to take this opportunity of saying that this is a bona fide contract."

What would be the price of the Air Holdings aircraft? The "going price," said Mr Haughton, whether they were sold by Lockheed or by Air Holdings. The sales job would be a joint one; sometimes a sale would be by Lockheed, sometimes by Air Holdings, sometimes by the two teaming up together. Once the aircraft were bought, whether from Lockheed or from Air Holdings, they would have the same contract guarantees.

What was the going price; and what was the launching cost? \$15 million depending on customer requirements; and \$350-\$400 million (about £150-£170 million).

Would the 1011 lead to a phase-out of the 707 and DC-8, and were there any discussions with supplementals? Yes and yes. Would the stretched 1011 compare with the 747? The longer its range the wider its market. "One day," said Mr Haughton, "the 1011 will have a plug, and maybe the competition will sell fewer."

Was a twin-engined version planned? Lockheed had looked very hard at a twin before deciding on a trijet. "We are looking at a twin now, but it's in the study phase. As to

which engine, we haven't made any decision, but if it came out it would be logical to assume that we would use the present nacelle."

How much could the 1011 be stretched before the length was limited by take-off rotation? It could grow to 200ft (from the present 177ft) increasing passengers by 80 to 375, making it "a sort of junior 747." Gross weight was a function of how much engine power was available: three 50,000lb engines would match a gross weight of 510,000lb (compared with the present 409,000lb). Over what production run did Lockheed hope to amortise costs? Mr Haughton: "We hope to sell enough by the end of this year. I am sure this doesn't answer your question but a lot of other people would like to know and they are not in this room!"

The mock-up

In the mock-up you can see the size of the 1011's cabin but, to adapt Mr Haughton's Grand Canyon analogy, you can't believe it. Although it is not quite as big as the Grand Canyon, awe is relative.

It seems almost a shame to defile such an Ark with so many human animals, two-by-two, two-by-two. The barbarity of the triple chair is banished, but you will still have to like people, because there are going to be quite a lot of them everywhere.

Many new-technology courtesies will compensate, however. A coatrack and hangars for your jacket by each pair of seats; lockers for brief-cases, duty-free bottles, and those other concussing objects that stewardesses order out of old-technology hatracks; armrest service-buttons; kitchen sounds, sights and smells below deck, with meat'n'two veg coming up in lifts—with jumbo-sized shrimps, if the airlines are true to Lockheed's mock-up.

First picture of the RB.211 mock-up, almost as big as that of the RB.207 (then 47,000lb) two years ago. The fan is missing from this mock-up. Initial thrust of 40,600lb will grow to 43,000lb by mid-1973, to 44,300lb by late 1973, to 46,500lb by mid-1975, and to 50,000lb later. Mass flow through the high-pressure compressor exit has been sized for this growth. Basic dry weight is 6,350lb, by-pass ratio 5:1, pressure ratio 27:1, and cruising s.f.c. 0.628 at 35,000ft and 0.85 Mach



AIR TRANSPORT...

BOAC GROUNDED

MISTRUST of the corporation management and general disgruntlement seem to be the only two factors which have kept BOAC pilots out on strike since June 16. As we went to press, 37 BOAC aircraft were idle on the ground at Heathrow, with another two at Wisley where they are being fitted with automatic-landing equipment. The other ten aircraft are operating out of Manchester or on the New York-Caribbean shuttle. The maintenance position is such that the whole fleet will probably be back in London by the coming weekend.

Basic official reason for the strike is a protest against the length of time taken to get a new agreement for service. After talks at the Department of Employment and Productivity on June 14 the pilots objected to the fact that a five-point peace plan did not contain specific deadlines for the agreement of a new pay and productivity structure and that it did not specifically say that any new structure should be other than a flat-rate system. Those two relatively minor issues are keeping the BOAC aircraft idle.

Given firm dates and a firm guarantee that a pay structure based on hours flown would be negotiated, the pilots would return to work. Both BOAC and the pilots have agreed that the negotiation could be helped by an independent chairman and that whatever agreement was made would be subject to Government approval.

Just after the strike began the chairman of BOAC, Sir Giles Guthrie, and the chairman of BALPA, Capt Roy Merrifield, met for a private and informal lunch.

NEW LOOK FOR CANADIAN PACIFIC

IN an effort to create a "better public awareness" of its breadth of operations as "the world's largest privately owned multi-modal transportation system," the Canadian Pacific organisation is to restyle all its aircraft, railway rolling stock and locomotives, ships and hotels. The principal change is the introduction of a new symbol—made up of a triangle, a segment of a circle and an incomplete square—and this will begin to appear before the end of the year. The colours used will be orange on aircraft, red on trains, green on ships and blue on the railway. The simple italic block letters "CP" followed by "Air"—or, for instance, "Rail," or "Ships"—will be used for identification (see picture on opposite page).

THIRD AIRPORT COMMISSION MEMBERS

THE names of those on the commission of inquiry into the third London Airport were named last Monday. As already announced, Mr Justice Roskill is chairman and the members are: Prof Colin Buchanan, professor of transport at the Imperial College of Science and Technology; Mr A. Goldstein of R. Travers, Morgan and Partners, consulting engineers; Mr A. J. Hunt, principal planning inspector at the Ministry of Housing and Local Government; Prof David Keith-Lucas, professor of aircraft design, College of Aeronautics; Mr Arthur Knight, finance director, Courtaulds Ltd; and Prof A. A. Walters, professor of econometrics and social studies at the University of Birmingham.

New Director for IAL Mr Ken Ayres, the chief executive of International Aeradio, has been appointed to the board. He joined IAL in 1947 soon after its formation and was appointed chief executive in May last year.

Aer Lingus Secretary Mr Niall G. Weldon has been appointed secretary of Aer Lingus, Irish International, in succession to Mr Patrick J. Brennan who, as already reported (see issue for June 6) is joining IATA. Mr Weldon, who is at present general sales manager, will take up his new post on August 1. He joined the airline in 1947.

ANA to Re-equip During the next few years All Nippon Airways plan to replace their 25 F.27s with NAMC YS-11s and their eight Viscounts with Boeing 737s. ANA is awaiting Government approval for an initial order for four 737s; orders for the first 16 YS-11s will be placed before the end of next year.

All Nippon Goes International All Nippon Airways, which has hitherto concentrated on Japanese domestic services, is preparing to operate charter flights to such cities as Seoul, Taipei and Hong Kong, beginning in the autumn, and using 727 and Viscount aircraft. As inclusive tours are not permitted in Japan, the airline will concentrate on affinity-group and other charters.

No Public Inquiry The Board of Trade announced last Monday, June 24, that there will be no public inquiry into the accident to the BOAC 707 G-ARWE at Heathrow London on April 8. As part of the routine investigation, however, a special group, including specialists in fire-fighting, will "look into all relevant matters relating to fire and rescue at the airport."

First Victim of IT Ruling Plans for a merger of Universal and American Flyers (see last week's issue, page 918a) have been indefinitely postponed. In a joint statement last week, the two carriers said that one important reason for the postponement was "the decision of the US Supreme Court denying the power of the CAB to grant to supplemental carriers authority to operate international inclusive-tour charters" (see *Flight* for June 6, page 849).

More One Elevens for Autair? The annual report of Court Line for the year ended September 30, 1967, says that two more BAC One-Elevens may be introduced in the spring of 1969 by Autair International, which is a wholly owned subsidiary. It also says that the airline suffered a "much reduced loss" and is now achieving the anticipated "swing round" with its modernised fleet and the inclusive-tour programme with the Clarksons Tours as the major client. The Viking freighters have been withdrawn and the Ambassadors will be out of service by the end of the summer.

History of the DC-3 The first volume of a history of the DC-3, produced by the London Amateur Aviation Society, is available at 7s 6d, post free, from LAAS International at 6 Popeswood Cottages, Binfield, Berks. This volume covers construction numbers up to 5,000, giving registrations and brief operating/ownership history of most of the aircraft built, starting with the Douglas Sleeper Transport (DST) for American Airlines, which made its first flight on December 17, 1935, and was delivered on July 11, 1936. It is illustrated with photographs of DC-3s in various airline markings.

Three different One-Eleven variants for three airlines were seen together recently at Hurn, Bournemouth—an event which is not likely to be repeated anywhere. On the left is BEA's Series 500; in the centre is a 400 for Taron, Rumanian Air Lines; and on the right is a Series 200 for Mohawk Airlines, the US regional carrier



MOSCOW-NY APPROVED

THE foreign air carrier permit, now approved by President Johnson, for Aeroflot's Moscow-New York service includes some mildly unusual traffic-right arrangements. In particular the relatively new "blind sector" principle has been applied. Both airlines have been given the choice of intermediate stops at Stockholm, Copenhagen, London, or Montreal, only one of which can be used, though a new choice can be made by each carrier before a winter or summer season. For initial operations Aeroflot, as already recorded, has chosen Montreal and Pan American has chosen Copenhagen.

Blind-sector traffic has been defined by the CAB as that which is moving solely between two foreign points, not included in the original bilaterals, on routes serving the home country. For Aeroflot the blind sector is New York-Montreal, while for PAA it is Moscow-Copenhagen. The Russian carrier can therefore carry sector passengers only between Moscow and Montreal (or any other point chosen later from those approved) and PAA can carry them only between New York and Copenhagen. No date had, at the time of going to press with this issue, been set for the start of the service.

STOL IN PRACTICE

DEMONSTRATIONS of the feasibility of STOL inter-city operations are to be made in the air-shuttle area of New York, Boston and Washington by McDonnell Douglas and Eastern Airlines for a six/seven-week period in September/October. The aircraft to be used will be the Breguet 941—which is to be given the designation, when modified, of McDonnell Douglas Model 188.

The 941 will probably be flown over from Paris in late July to the McDonnell Douglas plant at St Louis, Missouri, where it will be fitted out with special instrumentation and where Eastern pilots will be trained in its operation. Late in August it will be flown to Washington National for demonstrations to the Department of Transportation, the FAA, the CAB, NASA and other interested agencies. In September it will be flown to New York and for about six weeks it will be operated over Eastern's shuttle routes, with flights into Boston, La Guardia (New York) and Newark (NJ) and Washington National. No fare-paying passengers will be carried.

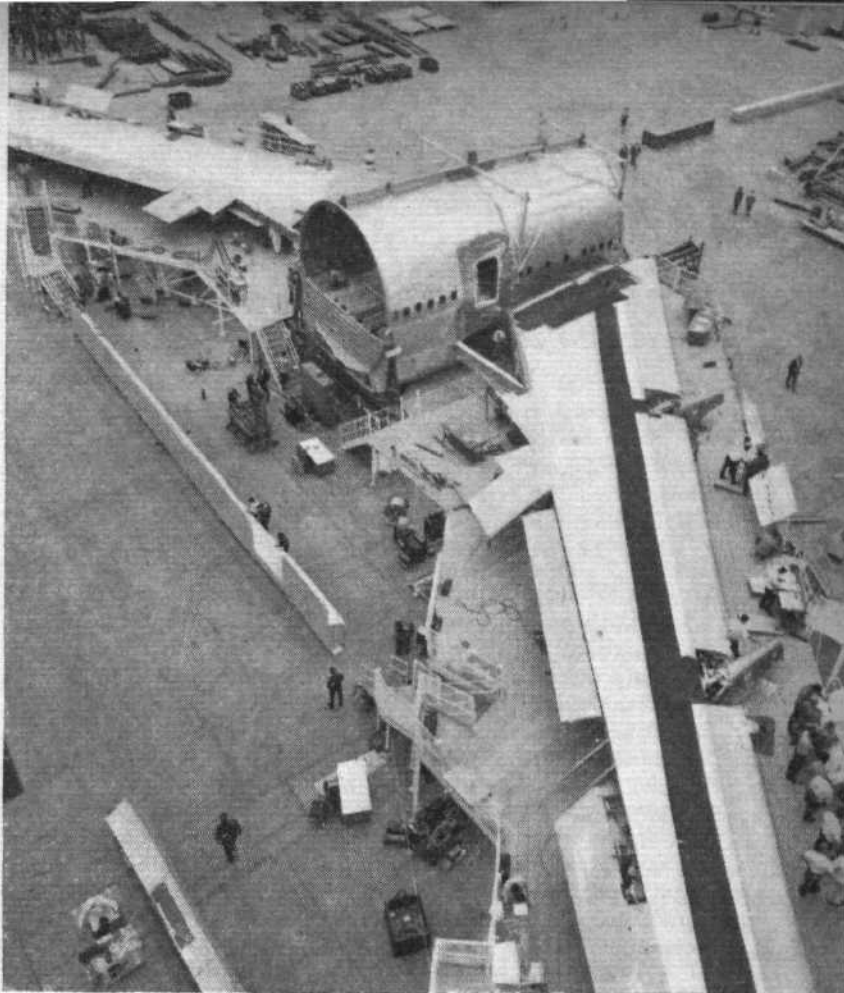
The objectives of the programme will be to establish operating procedures governing STOL operations; to determine the feasibility of STOL operations from existing airports without interference with existing traffic; to discover the overall cost and time savings achieved by such operations; and to evaluate appropriate navigation and guidance systems.

At the conclusion of the demonstration, an evaluation will also be made by Eastern of STOL performance as compared with that of the DC-9-30s now used on the air shuttle. This analysis will cover such items as the ground time for passengers, the need for the construction of new facilities, the actual block-to-block time between cities, operating costs and servicing requirements.

GETTING THE PASSENGER OUT

IN a move to increase the chances of passenger survival following crashes at or near airports, the Canadian Department of Transport has positioned a new type of one-man-operated, high-speed rescue truck at five international airports in Canada. Each vehicle is designed to enable the driver, after reaching the crash site, to operate a high-capacity roof-mounted dry-chemical turret to combat flames at the point in a wrecked aircraft which provides the best prospect of immediate entry or exit, giving surviving passengers a better chance to escape.

The Department says that in actual rescue operations the major foam fire-fighting equipment would be on the scene to handle the main fire-fighting job by the time the initial work of the high-speed truck was under way. The availability of the rescue truck in the early moments after a crash would, however, increase the chances of survival. The new trucks have devices, hydraulically operated, for opening jammed doors and pulling apart metal structures to provide or force an opening in a fuselage. The equipment also includes an electric generator for emergency floodlighting and a source of power for metal-cutting tools or saws.



The centre fuselage section and wings of the first Boeing 747 have been joined at the Everett, Washington, plant. Leading- and trailing-edge devices and fuselage components are now being installed. The next move will be the attachment of the forward and rear fuselage sections, with the tail section, undercarriage and main wing flaps added at about the same time. The first flight is scheduled before the end of the year

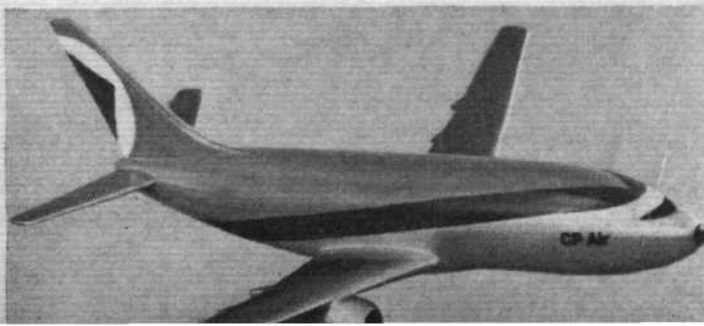
Another Hercules for PWA? A second Lockheed L-382 Hercules will be obtained by Pacific Western Airlines if the carrier is successful in winning the contract to provide support services for the Canadian Panarctic oil exploration project.

Air West Orders 727-200s The recently formed airline Air West—the result of a merger of Bonanza, Pacific and West Coast—has ordered two Boeing 727-200s for delivery early in 1970 and has taken an option on two more. Air West plans to standardise with a fleet of DC-9s and 727s.

Irish to Standardise on -320s Two additional Boeing 707-320s have been bought by Irish International from an unnamed US airline for delivery next spring. The airline's two smaller-capacity 720s will be offered for sale and the North Atlantic fleet will then consist of six -320s.

GE Engines for AA's 1011s As expected, American Airlines have chosen the General Electric CF6 engine to power the units in their 25-strong (with 25 more on option) fleet of McDonnell Douglas DC-10s. United Air Lines had already selected the CF6 and American's decision was almost a foregone conclusion.

How Canadian Pacific's new livery will appear on one of the airline's Boeing 737-200s. The colour scheme will be orange on the upper portion of the fuselage, with a broad red stripe at an angle below. The airline's new symbol is on the tail. See paragraph on opposite page



AIR TRANSPORT...

From Examination to Action

A Plan for British Civil Aviation

A PROPOSAL that British air transport policy should be developed and guided by a "council," on which all essential interests are represented, and controlled by a greatly strengthened independent licensing authority has been offered by Mr N. Ashton Hill to the Edwards Committee. On the appointment of this committee he prepared a paper—as chairman of the Air Transport Committee of the Association of British Chambers of Commerce, but expressing views which were not necessarily those of this organisation—in which British civil aviation was examined in some detail (see *Flight* for December 21, 1967, pages 1025-27). This has led logically, following a request from the Edwards Committee for specific recommendations, to a second paper entitled "A Plan for British Civil Aviation."

Starting with the assumptions that the British air transport industry should be developed to the fullest extent and that enterprise and competition are essential for its maximum development, the paper goes on to mention the three main courses open for the operation of air transport. These are a single monolithic organisation; a proliferation of units; or a concentration of units into sizeable groups. Of these the third appears to offer the maximum possible benefit.

As a result of past history, Britain's principal scheduled services are operated by the two State corporations. As the Minister (now the President of the Board of Trade) has responsibility for financial results of these corporations, any licensing authority must be autonomous and free from political interference. A system of licensing must be accepted, but the maximum growth of the industry depends on new ideas and the maximum co-operation on all sides of the industry. A forum for discussion is therefore essential.

Hence the proposed establishment of a council with high-level representation from users of air transport, nationalised and independent airlines, the airport authorities, the SBAC, the Board of Trade, the Foreign Office and the travel agents' association. The council would have no authority as such, but would bring to bear a weight of worthwhile opinion. It would have an independent chairman with legal qualifications.

The licensing authority would be an independent and strengthened extension of the existing ATLB and be composed of some three members, full-time and highly paid, of enterprise and ability. The board would be autonomous and its decisions would be subject only to an appeal to the Courts on a point of law.

The board's staff should consist of a number of "examiners"—persons trained by the board to relieve it of "run of the mill" hearings though their decision would be subject to board approval—a statistical and records branch with the responsibility for collating and publishing all relevant information; a traffic-rights branch having direct access to the Foreign Office in matters of bilateral treaties; a liaison branch to keep in contact with the licensing authorities of other countries; and an air-safety branch.

The board's duty should be to create and establish the British civil aviation industry so as to fulfil the requirements of public necessity and convenience. These should cover services, safety and statistics. Its immediate tasks would be these:

(a) To rationalise the existing situation where the only worthwhile patterns of scheduled services are exclusively held by the nationalised corporations on unlimited licences with unlimited frequencies. (b) To determine areas of development—in distinction to the grant of a single licence—and to ensure that a licensed operator has a reasonably viable pattern of scheduled routes. A system is required which ensures that every scheduled operator has to accept some worthwhile, but immediately unprofitable, routes with those which are profitable.

Other tasks of the board would be (c) to determine spheres of influence for the future; (d) establish a national airports plan and to revise it from time to time; (e) encourage the development of air services, particularly those out of provincial airports which are suitable for international operations; and (f) licence a pattern of domestic and "feeder" scheduled services which makes a viable and economic pattern for a number of British operators.

It would also be expected (g) to expedite licensing procedures (the award of costs against an unsuccessful party in all licensing cases might make all operators more alive to their responsibilities as applicants or objectors); (h) consult with the Foreign Office in order to ensure that bilateral agreements are adjusted so that the decisions of the board are meaningful; (i) examine and control the fare structure both domestically and internationally and to represent HM Government in IATA matters; (j) establish a safety organisation which will regulate and monitor the standards with which air transport operators will be required to comply; and (k) control and administer subsidies for the establishment and operation of airports and air services which are "social" and non-profitable, or which require development expenditure.



A mock-up of the fuselage of the L-410 Turbolet, a 17/18 passenger twin-turboprop being developed by the Let national aircraft works at Kunovice, southern Moravia, Czechoslovakia. It is being designed for operations over 60-250-mile stages. The prototype, due to fly next year, will be powered by M-601 engines

AIR TRANSPORT...

MEA Bargains on Two Fronts

Equipment Purchases and Merger Talks

WITH A TOUCH of Hitchcock-like suspense and an interminability reminiscent of "The Fugitive," the question of MEA's re-equipment has meandered along for over four years, coming to the boil occasionally in a flurry of inspired speculation. It is about to bubble up once again now that the financial background to the company has stabilised. At the same time MEA is faced with a Lebanese Government order to merge with another national carrier, Lebanese International Airways, which is said to be in severe financial difficulties.

The re-equipment problem was virtually settled some years ago when MEA put down a deposit on three Douglas DC-8-62s, but Douglas withdrew from the deal when the Intra Bank collapsed in 1966. The Intra Bank controls 65 per cent of MEA and the failure of the bank was inevitably reflected in the airline. Eventually the \$20 million deficit (£8.3 million) was loaned to the bank by the American Commercial Credit Corporation, which issued shares to that value, forming the investment holding company to control the bank. Creditors were allotted shares proportionate to their claims.

This now puts MEA back in the same position as it was before the Intra crash, but with considerably more obligation to American interests than it ever had before. It is said that this American pressure is having a strong influence on the airline in its renewed search for equipment to replace its ageing Comets and Caravelles.

The immediate requirement is for four aircraft—either the Boeing 707-320 or the Super VC10—costing a total of \$40 million and \$43 million respectively with spares (£16.6 and £18 million). Earlier this month MEA's general manager, Mr Asad Nasr, reiterated the company's liking for the VC10 despite the cost penalties involved. Although MEA has two VC10s on lease at the moment, one from Ghana and another from Laker Airways, the exact cost differentials are difficult to work out, he said. But against the cost differences, of the order of five to ten per cent, Mr Nasr said that the company had certainly felt the effect of passenger preference for the VC10. It was not as well-defined on the London-Beirut-Gulf Coast routes which MEA operates as it is on the Atlantic because of the fragmentary statistics available; but he produced figures extracted from Atlantic route statistics which showed the clear preference which was shown on that route for the VC10.

When the type was first introduced the load factors on VC10 services were 50 per cent higher than on competitive aircraft, but since then the difference has narrowed, and naturally fluctuates with the seasons. Last year in the summer the difference was 15 per cent, while in winter, with a freer choice of aircraft seats because of the lower overall load factors, the figure doubled to 30 per cent. This is one of the bases on

which MEA is sticking out for using the British aircraft, or at least using its presence as a strong lever on Boeing to obtain more favourable terms.

While I was in Beirut, MEA executives were holding virtually non-stop talks with Boeing and BAC, and were said to be gradually bringing the Boeing price down. The best card in Boeing's hand is the fact that they can deliver a -320C to MEA in October, thus allowing the company to terminate its use of the -320C it has been wet-leasing from British Eagle since the beginning of this year. The VC10 decision will very much depend on delivery date and price, with the former being critical.

Intermingled with all the negotiations on equipment is an equally intense flurry of managerial activity on the question of the merger with Lebanese International Airways. Mr Nasr said that there was no commercial desire by either MEA or LIA to merge, although the two operate joint timetables already. The merger is being forced on the companies by the Lebanese Government, which is anxious not to have a further financial embarrassment after the Intra collapse. LIA is said to be going bankrupt, with an accumulated deficit of some £40 million Lebanese (£5.4 million sterling). The deficit, said Mr Nasr, is so substantial that the merger could not be a commercial proposition. Talks are now going on between MEA and the Lebanese Government to work out the amount and form of financial assistance which MEA is insisting that the Government should provide. The Government does not want the embarrassment of having the airline closed down and is likely therefore to agree to some form of compensation.

This is probably also the key to the re-equipment question, for not until the LIA arrangement has been settled will MEA be in a position to know what its fleet requirements and its economic position will be. The Lebanon needs tourists unless its economy is to decline considerably, and this year the pinch is already being felt after the siphoning-off of many former visitors to Lebanon to the newly owned antiquities on the Israeli-occupied West Bank of the Jordan river.

The re-equipment decision was originally due to be made on June 7, then was postponed until the 13th; but that date, too, has apparently gone by the board. As the leasing arrangements which MEA has with Ghana, Laker and British Eagle will no doubt be eating into profits, there is greater incentive than ever before to bring the decision to a conclusion as quickly as possible; for, in the face of a declining Lebanese economy, MEA is still growing. Despite the June war, passengers carried increased by over ten per cent to nearly 442,000 last year, with a load factor of over 56 per cent in spite of the additional capacity the airline gained from the leased VC10s.

J.B.B.

Training Merger in Holland Schreiner Air Transport has bought the shares of NV Nationale Luchtvaartschool (NLS) from the Royal Netherlands Aero Club. NLS will be merged with the Schreiner Air Training School and the new unit will continue under the NLS name. There will be two sections—one for private pilot training and the other for training up to air transport licence standards.

Ready for Action With ARB approval for Britannia maintenance and overhaul, and with the hangar conversion complete, Airline Engineering of Luton Airport is now able to take in contract or *ad hoc* work from airlines or manufacturers. The company was originally projected early last year as an organisation to look after the fleets of Caledonian and Lloyd.

This plan did not mature and the company has since been reconstituted, with a base at Luton, to carry out maintenance for the associated Monarch Airlines. The Luton Corporation has converted two BAC hangars into one, with a floor area of 46,000 sq ft, capable of handling the largest aircraft now in use.

JFK Extension The first construction contract has been awarded in the project to double the size of the international arrivals and airline wing buildings at John F. Kennedy International, New York. The expansion programme is to be completed by early 1971 and work on the first contract for the foundations started this month. Forecasts for JFK say that overseas passenger numbers will increase from 6.7 million in 1967 to 14 million by 1975.



A revised styling has appeared on the last of Iberia's eight DC-8 Series 50s to be delivered, a -50F, seen here at Madrid's Barajas Airport. The first of three DC-8-63s will be delivered to the airline later this year

AIR TRANSPORT...

THE COST OF QUIET

THE elimination of a provision in the US noise-abatement Bill which would allow the FAA to require the retrofitting of noise-reducing devices was requested last week by the president of the Air Transport Association, Mr Stuart G. Tipton. He told the Senate aviation sub-committee that the general principles of the new legislation were supported by the ATA, but pointed out that the retrofitting of 700 four-engine jets with noise-reducing nacelles and acoustically treated inlets and ducts would cost between \$500 million (£210 million) and \$800 million (£330 million).

He said that the "amount of noise reduction which can be expected from the installation of the nacelle and acoustical treatment (now under development by NASA) cannot at this time be ascertained, if indeed any significant lessening of fly-over noise will result . . . The expenditure of such large sums could conceivably be worthwhile. It is equally conceivable that the actual favourable effect of these tremendous expenditures would be negligible."

The Secretary of the Department of Transportation, Mr Alan S. Boyd, described the acoustical treatment of nacelles as "the foremost possibility" in present efforts to develop a noise-reducing retrofit. This procedure would, he said, be much cheaper than installing new engines; any retrofit programme would need to be judged to be "technically and economically feasible" before it would be ordered by the Government. "We have no thought of grounding existing aircraft because of noise," he added, according to *Aviation Daily*. "We wouldn't do anything without very detailed discussions with the aircraft manufacturers and operators, and if they offer a different approach than ours we would be flexible . . . But if we come up with a retrofit programme that is economically and technically feasible we would expect the operators to retrofit within a reasonable period of time."

FLEET RECORD

WITH the May-June issue *Esso Air World* has produced its periodic supplement giving the turbine-engined fleets of the world's airlines—including aircraft on order—corrected to May 15, 1968. Altogether the listing includes information about 25 turbojet and 19 turboprop types and their variants, of which there are totals respectively of 3,758 and 1,534 in service with, or on order for, some 270 individual airlines, from Air Alpi to Zambian Air Cargoes. The details include engine types and marks for each variant, and, in the remarks column, leas-

ing information where this is available. The listing is broken down into aircraft in service and those to be delivered during this year and from 1969 onwards. No doubt there are errors—such compilation can never be absolutely correct—but this is a massive listing which will, as always, be very valuable to those in the aviation industry and others.

SPEEDING THE PASSENGER

THE idea of a passport card, about the size of a plastic credit card, was favourably received at a recent meeting of the ICAO Facilitation Division in Montreal as one of a number of ways in which airport delays may be reduced. The meeting asked ICAO to set up a panel to investigate the form which a passport card might take, and the types of automatic and manual systems that would be needed to handle it. Other recommendations dealt with the streamlining of Customs inspection procedures, the elimination of routine baggage weighing for high-frequency flights, and the encouragement of checking-in at town terminals to relieve airport congestion.

The recommendations will go for approval to the ICAO Air Transport Committee and the Council.

Redundancy in Jersey? One effect of the merging of BUA(CI) and BU(Manx)A into CIMAS (see *Flight* for June 13, page 885) is, according to local reports, likely to be a 50 per cent reduction of staff, involving about 250 persons.

Air Cargo in Scotland Mr George Greenaway has been appointed to look after cargo sales for Aer Lingus in Scotland. Before joining the airline he was assistant manager of Scottish Express at Glasgow Airport, Abbotsinch.

Southampton Manager Mr Colin H. Barwell has been appointed airport manager at Southampton. He succeeds Mr Brian Grant who, as reported in last week's issue (page 919), is now airport manager at Swansea. Mr Barwell retired from the RAF with the rank of Squadron Leader last month after 26 years—15 of them as a flying instructor.

Shared Award A staff suggestion scheme award of £200 has been shared equally between two technicians of the BoT Civil Aviation Flying Unit (CAFU) at Stansted. The awards were presented by Mr J. P. W. Mallalieu, Minister of State, BoT, on June 24 to Mr Robert W. Phillips and Mr Patrick M. Moylette. They are employed on the evaluation, planning and operation of flight inspection equipment for radio and navigational aids and their suggestion involved a modification to the Teleroscope equipment used in checking the accuracy of ILS glide-paths.



Separation Margins Undermined?

SAFETY IS A PHILOSOPHICAL CONCEPT and in this respect this column endeavours to maintain a certain amount of philosophical consistency. It branches out a little way into technical studies on performance, separation standards and the like, but from time to time throws up a number to relate these to the aeronautical ethic as a whole—see, for example, "A Long Shot at Air Safety" (December 15 and 29, 1966) and "Subject Round-up" (March 9, 1967). This week I propose to link up with a very early number (April 18, 1963) in which, dealing with performance philosophies, I introduced the term *le mensonge aéronautique*.

I do not propose to deal with performance here but find the idea of an all-permeating *mensonge* useful in another context, this time on instruments. But first let us go back to the original thought. This was generated by studies on the history of the French colonial empire which, in the early part of this century, came under a sustained (mainly internal) attack on the lines that territories such as Algiers and Tunis could in reality never be part of metropolitan France, in spite of sending deputies to Paris, and that the whole idea of a single administrative, social and economic complex yielding the greatest good for the greatest numbers was a fiction. The disparate attacks on the system were held together by the phrase *le mensonge colonial*.

Now I do not want to make too much of this analogy (and even less to extend it to other empires), but I do want to steal the word *mensonge* which, in the context given, means much more than a simple lie or fib. It means a wide-spread fabrication leading to a false philosophy.

Which leads me to the fabrication relating to the altimeter Type III (US version). This is part of the sub-family of *mensonges* the parental tree of which begins with the maternal *mensonge navigational*, gives birth to a whole family of *mensonges instrumentaux* which, in turn, generate the special case of *le mensonge altimétrique* which we are dealing with here.

The last time I wrote on altimeters was on February 15, 1968 (page 218), and this gave rise to some very helpful comment from Mr A. du Feu in the March 7 issue (Letters, pages 334-335). He called my attention to the fact that many quite modern aircraft still rely on ICAO Type IA or Type II

altimeters, as distinct from the more accurate servo-driven Type III. I have since learnt that this may be something of an understatement in that most American jets—which means most jets—rely on altimeters the accuracy of which is related to ICAO Type II standards and not Type III.

But they are widely referred to as "Type III." More than that, there is a tendency to base the whole of the proposed reduction of vertical separation on the widespread use of the ICAO Type III tolerance figures even though these tolerances are not met by the majority of altimeters in use today—or expected to be in use in the near future. Here are the comparative figures:—

Height (ft), standard atmosphere	Tolerance (ft), ICAO Type III altimeter	Tolerance (ft), US Type III altimeter
0	30	20
1,000	30	20
2,000	30	20
3,000	30	30
4,000	30	35
5,000	30	35
10,000	50	80
20,000	75	130
30,000	120	180
40,000	150	230
50,000	180	280

If 1,000ft vertical separation were introduced, at 40,000ft any two aircraft tested to US Type III standards could have used up 460ft of separation on their instrumental tolerances alone—not to mention static-source, static-line and flight technical errors. The 80ft difference in the tolerances (100ft at 50,000ft) may seem small, but once one gets down to talking of 1,000ft separation such differences are of the utmost importance.

You will perhaps now see the thought in this connection behind the use of the word *mensonge*. The concept which I am endeavouring to put across is that of an insidious, all-permeating fabrication. Just as *le mensonge aéronautique* applied to the stalling speed undermines the performance margins, so does *le mensonge altimétrique* undermine the separation margins. Safety as a philosophical concept is affronted.

13,000ft FOR SYDNEY

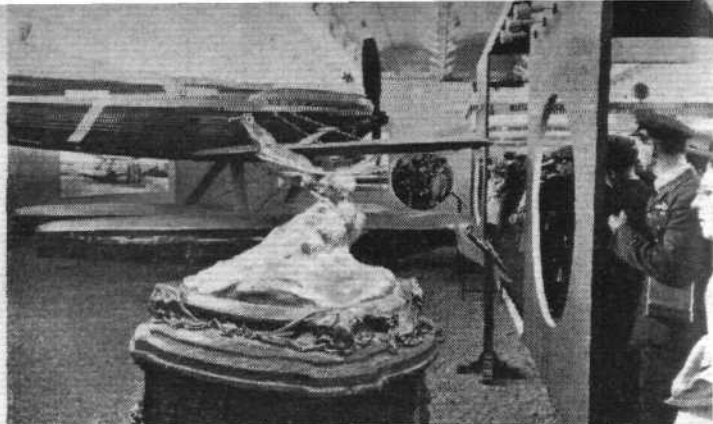
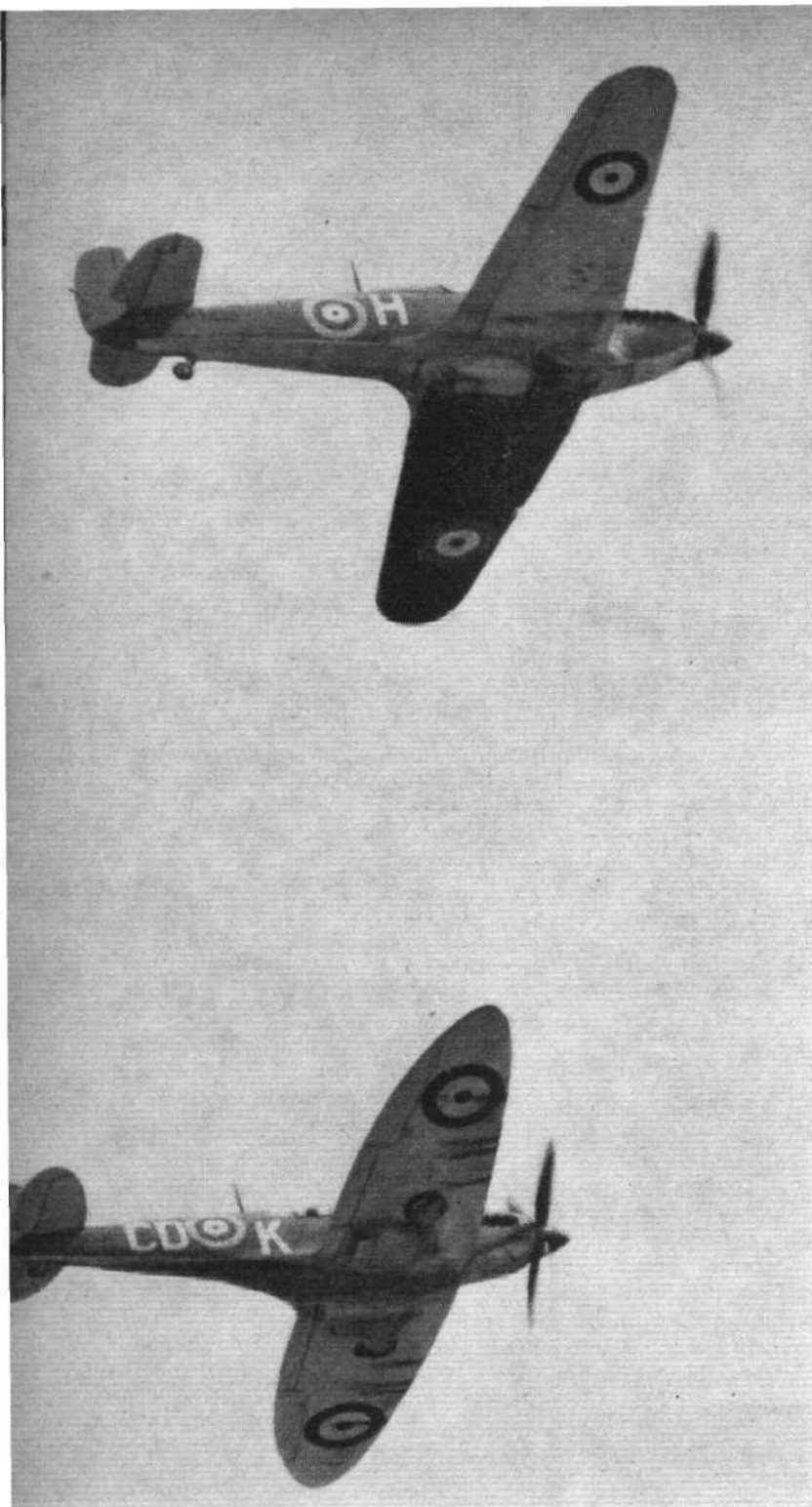
THE Australian Government has approved an extension into Botany Bay of the north-south runway at Sydney (Kingsford Smith) Airport to a length of 13,000ft. The extra, dredged-fill, reclamation needed will provide not only for the additional runway length and supporting taxiways, but also for the installation of very high-quality low-visibility landing aids. The earlier planned length was 9,100ft, but this has been found to be inadequate for the fully loaded Boeing 747 and the SSTs. The revised length of 13,000ft was decided upon after discussions with aircraft manufacturers, airlines and other airport authorities. It will permit the 747 to take off and fly non-stop with a full payload to points such as Singapore and Manila even in the high summer temperatures normal to Sydney. The extension will cost about \$23 million (£11 million).

Construction will be scheduled in such a way that there will be sufficient length available for those Boeing 747 services which Qantas expects to introduce late in 1971. The whole project is expected to be completed early in 1972. When this and other projects now in hand have been finished, the Commonwealth will have spent about \$120 million (£56 million) on the development of the airport.

Pooling in Japan All Nippon Airways and Japan Air Lines have concluded an agreement for pooling the proceeds from services between the four main points in Japan—Tokyo, Osaka, Fukuoka and Sapporo. The agreement, which is aimed at "eliminating excessive competition" is renewable after one year.

Aurigny Services Expand The Alderney-based company, Aurigny Air Services, set up by Glos-Air to take over the Alderney-Guernsey service from BUA, started Alderney-Jersey and Guernsey-Jersey services last month. For several years it had been possible to fly between Alderney and Jersey only via Guernsey. Three B-N Islanders were in service with Aurigny last month, with another due for delivery.

New Maintenance Base for PAA In addition to the modernisation of existing maintenance facilities at John F. Kennedy International, New York, Pan American is to build a new \$57 million (£24 million) maintenance base at the airport for the overhaul of Boeing 747s and Boeing SSTs. To be known as the Jet Centre, it will be located on a site at the south-west corner of JFK. The remodelled present base will be used for Concorde as well as for existing jet equipment.



The Schneider Trophy, won outright for Britain in 1931 by an RAF team, and one of the Supermarine S.6B seaplanes which helped to win it

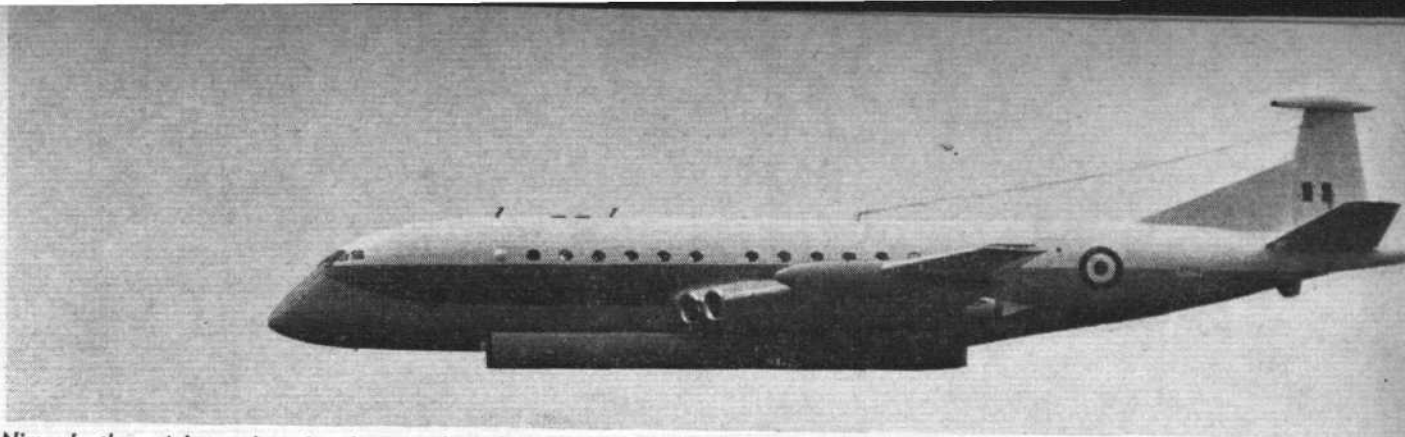
ABINGDON POSTSCRIPTS

"RAF ROYALLY REVIEWED" in *Flight* last week conveyed something of the splendour and excitement of those memorable June 14/15 days at Abingdon; but two pages could do scant justice to the rich aeronautical variety of the occasion. On these two pages, therefore, appear more photographic records of the Royal review—which, judging from personal observations and from letters which *Flight* has received, will long be remembered in the minds of those who went to Abingdon on either the Royal or public day

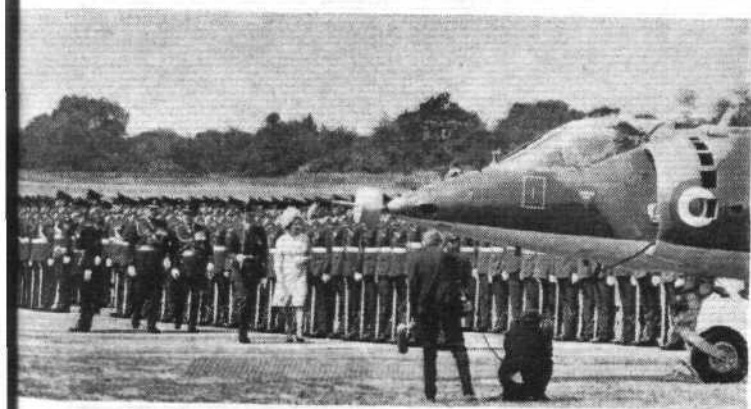
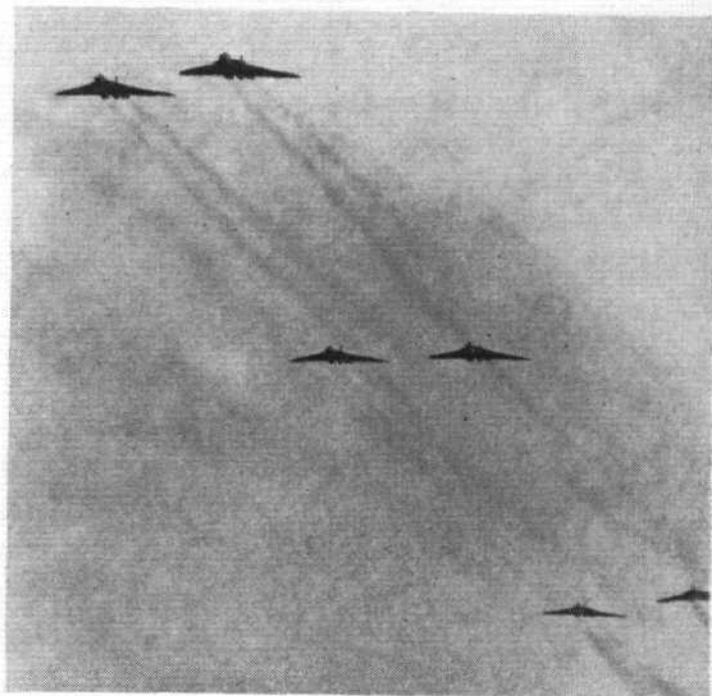
"FLIGHT" PHOTOGRAPHS

Battle of Britain victors, the Spitfire and Hurricane (above); below, the first V/STOL fixed-wing aircraft to be operated by any air force, a Royal Air Force Harrier, over an Air Support Command Belfast; and at right below, ground-attack Hunters of Strike Command demonstrating their powers

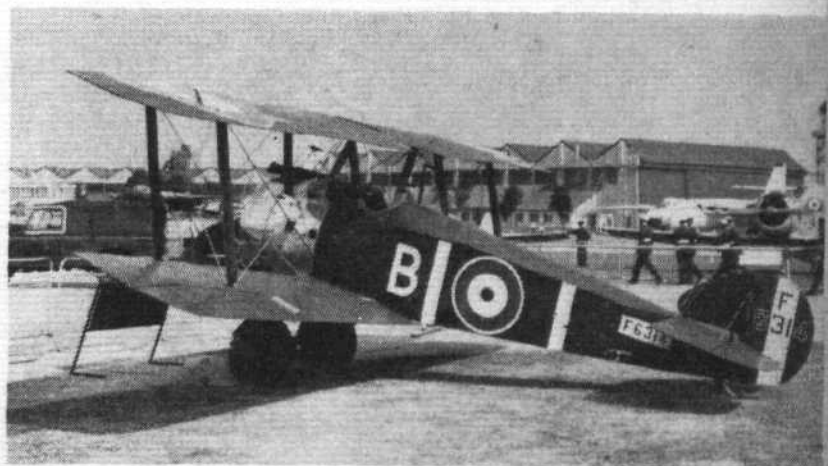




Nimrod, the mighty submarine hunter, formidable addition to the RAF maritime squadrons; below left, sprightly Sioux; and below right, the power of the deterrent force symbolised by approaching Vulcans of Strike Command



The Queen reviewing the Queen's Colour parade, with a Harrier flanking it; and at right, one of the RAF First World War veterans, a Sopwith Camel, with beyond it a Valiant, Harvard and Vulcan



A Hercules of Air Support Command showing-off its low-level, low-speed heavy-dropping role



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SPORT AND BUSINESS



A double celebration at Shoreham—the 300th hour of commercial flying by the first Beagle Pup to fly with a school, and the 21st birthday of the pilot on the occasion. At the controls was Miss Vivienne Tidmarsh seen here with her instructors, l to r, Harry Birch, Wg Cdr George E. Lowdell and Ken Dowell. See also this page for Shoreham School of Flying reactions after the first 300hr of Pup flying in two months

Pup Reactions Since taking delivery of the first Beagle Pup-100 in April, the Shoreham School of Flying has obtained some remarkable results. Chief among these is the reduction of around 30 per cent in time-to-solo for *ab initio* pupils. Whereas the average has been about 15hr on the American and European types used by the School, the Pup average is nearer 10hr. Another notable feature, which is all the more remarkable in applying to the first aircraft delivered, is that the achieved utilisation is high—300 hours in eight weeks, or more than five hours a day.

Capt M. J. Kirby, an airline captain with Transglobe Airways who is also CFI of the Shoreham School, has expressed some unequivocal views on the Pup. He says, "It is a classic . . . a truly marvellous training aeroplane. It has wonderful vision and beautifully balanced controls. The student finds everything fitting in with one type of pressure on the controls. The Pup is way up and beyond the modern handling standards of light aeroplanes—definitely.

"It has a much superior landing presentation. The flap

system is fantastic—almost like having built-in dive brakes. You can poke on a bootful of rudder and it will go sideways; you can hold the speed high and it will go down fast, or you can slam on power and it immediately comes out of the landing configuration and scoots away. On the other aircraft pupils are always asking 'Am I too high?' or 'Am I too low?' but with the Pup you can show the pupil that because of the remarkable flap system and the immediate throttle response the aeroplane can at once be put in exactly the position you want.

"I am sure this matter of bringing the hours down is because of this natural thing the Pup has. It is splendidly comfortable; everything is to hand just where it should be; the vision is exceptional; the engine is well ahead of you so it is nice and quiet; you sit side by side with bags of room and you've got a first-class intercom system so that you can talk quietly and easily. On top of that you've got a wonderful undercarriage that just laps up punishment on hard, rough ground, and finally you've got this marvellously harmonised and balanced control system. So far as training aeroplanes are concerned there is no doubt at all that the Pup is a big advance in the state of the art."

The first production Swearingen Merlin IIB has rolled off the line at San Antonio, Texas. The IIB powered by the Garrett-AiResearch TPE 331-1-151G replaces the PT6-powered Merlin IIA. Deliveries have begun. One of the first customers is the Australian DCA



Training in Britain Omitted from the list of British clubs and centres where flying training is available, given in *Flight* for May 30 (page 840), were the Flairavia Flying Club and the 600 (City of London) Squadron Flying Group, both of Biggin Hill Airport, Kent. The telephone number of the former is Biggin Hill 2163. (Neither club is affiliated to the BLAC or operates a BoT-approved course.) In the same list, the name of the Southend Aero Club should be replaced by that of the Southend Light Aviation Centre, Southend Airport, Essex (telephone: Southend 40201).

How to get Organised With the display season at hand, the Board of Trade is concerned lest organisers take insufficient precautions to ensure safety. The past record, it remarks, has not been good. To assist display planners the BoT has published a revised edition of the comprehensive guide which, introduced last year, is intended as a check list of necessary facilities and services. Copies of the pamphlet can be obtained from The Divisional Controller, Board of Trade, Civil Aviation Divisional Office, Southern Division, Heston Aerodrome, Hounslow, Middx.

Highlights of the 19th Reading Show. Left, Allison displayed a mock-up of the 317 h.p. turboprop version of the 250; this is an important contender in the new generation of six-seat twin-turboprop aircraft being designed by the leading companies. Right, Ted Smith showed the first production Aerostar 600 six-seater powered by two 290 h.p. Lycomings. In accordance with the long-declared plans of Ted Smith, the company has been taken over by bigger financial interests. The American Cement Co has bought the entire stock for some \$9 million (£3.75 million)



BUSINESS AVIATION

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Business aviation continues to mirror commercial air transport to a remarkable degree. Any company today with a highly mobile top management can choose exactly the aircraft for the last word in speed, range and total self-reliance. For trans-metropolitan commuting, the jet helicopter has revolutionised rotary-winged effectiveness. For medium-ranges there is a wider-than-ever choice of fixed-wing types from straightforward piston engine power through turbo-supercharging with cabin pressurisation, to the higher-flying and faster turboprop and, ultimately, to the jet. For global mobility, at the sort of price that only vast corporations, governments and potentates can afford, there is an exotic handful of long-range jets. In the following review, the accent is on the British scene. Individual articles consider the economics of operating the more commonly used types. Two charter companies are also described and there is a review of types of business aircraft currently available.

Costing a Jet

IT IS ALMOST IMPOSSIBLE for an outsider to say when a particular company could benefit from the ownership of an executive jet. All depends on the nature of the business—is it of a fairly even tempo, or do competitive pressures and so on force the staff into periods of intense activity and travel. If the former, then any kind of company aircraft must stand or fall on the plain straightforward test—can it save money in competition with alternative means of travel? But, in the latter situation, it is not unknown for the entire annual cost of a company aeroplane to be covered by one deal or action taken as a result of having high-speed staff mobility.

When talking of operating costs it is easy to become bogged in ideological talk of one sort or another in favour, or to become unduly intimidated by the scale of the costs when taking an opposing view. Experience shows that, of the commonly used types, from four-seat piston-engined twin, to ten-seat jet, all have approximately the same cost per seat-mile. The difference is that the small aeroplane only produces something like 102,000 aircraft-miles (or 408,000 seat-miles) per year, whereas the jet flies 240,000 miles (or 2,400,000 seat-miles). In simple terms, the jet is almost certainly the aircraft for a company with a daily travel requirement involving five or more people making a round trip of 400 miles or so each way. At the other end of the scale, the light twin can usually be justified on a passenger load of two or three people and a round trip of 150 miles each way per day. Both of these are simplified examples with a strict eye to cost effectiveness alone.

An annual utilisation of 600 flying hours was assumed in

making the general comparisons of the previous paragraph. In fact both types, and the jet in particular, are capable of far more intensive usage, with consequent reductions in the cost per mile. But any operation on this scale, even with only one aeroplane, really needs to be managed by a full-time administrator having an overall view of the company's transport needs. He must be able to spot ways and means of maximising the value from every flight.

To give a general indication of business jet operating costs the following discussion is based on figures supplied by the Technical Sales Department of Hawker Siddeley Aviation, Hatfield, for the HS.125 as it might be operated by a typical owner based in Britain. It should be stressed that these are not "formula" cost figures, but serious estimates based on rigorous analysis of the operation of more than 100 civilian HS.125s in service throughout the world. The total costs are well borne out by the rates quoted by Gregory Air Services (the only UK charter operator of an executive jet: see page 970). A minor warning when comparing operating costs of various types of aircraft: try and make it on the basis of a particular job to be done. Small variations in speed, for instance, between one type and another, cannot be usefully employed to increase the aircraft utilisation. Even at the high-by-business-aviation-level of 1,600hr annual utilisation, the aircraft is spending a considerable amount of time, fully serviceable, just waiting for its passengers.

Fixed Annual Costs Depreciation Company policy can differ widely over the method of writing-off capital equipment. The choice of method will depend on tax arrangements and the expected resale value. A typical depreciation rate is 10 per cent per year of the first cost of the fully equipped

Hawker Siddeley's new longer-range HS.125, already one of the best value-for-money business jets on the market, became even more competitive on the American market following devaluation of the pound. The type is the subject of a discussion of business jet operating costs which begins on this page



aircraft. Spares-holding depreciation is almost negligible because HSA has an over-the-counter unit exchange scheme. Although hardly any HS.125s, or any other executive jet for that matter, have come on to the second-hand market, there is reason to believe that resale values are still very high due to the scarcity, the increasing new price of these aircraft, and the lack of technical developments to render existing models obsolete or less desirable. It is, incidentally, almost impossible for aircraft manufacturers to indulge in the sort of planned obsolescence practices of the motor industry, because of the safety requirements. The HS.125 airframe is life-tested to over 40,000 flights—equivalent to 50 years of 800 1hr flights a year.

Insurance Executive jets like the HS.125 have a very good safety record, and the airframe insurance rate is around 1.5 per cent per year of the first cost of the fully equipped aircraft. Passenger and third-party liability varies widely, being dependent on the amount of cover required and the kind of airfields to be visited. An annual premium as low as £1,250 is not unusual.

Hangarage charges vary enormously around Europe. Typical rates per month for the HS.125 at major airports are: £28, France; £112, West Germany; £29, Italy; £111-£183, Sweden (according to whether it is winter or summer because of heating charges); and £29, Britain.

Crew A typical total salary allowance is £6,250 per year for two pilots (the legal minimum crew complement). The second pilot is not required by law to be any more than a basic PPL holder, but, for economic utilisation of a jet, it is not usually sensible to consider anything less than two full-time fully qualified pilots. Crew expenses, pension funds and other benefits add another 30 per cent or so to the salaries.

Hourly Costs *Airframe Maintenance and Overhaul* Estimated charges are based on a careful scrutiny of HS.125 experience; the aircraft is well established in service and has shown outstandingly good mechanical reliability from the very beginning. The labour times to do practically every maintenance and overhaul function on the aircraft have been checked by the makers and compared with experience in the field. The estimates are based on a cost-per-man hour (100 per cent efficiency) including overheads of £2 19s.

Engines The Viper 521 is already operating to 1,600hr between overhauls, and the 522 fitted to the latest aircraft is expected to reach that figure soon from the 1,400hr TBO at present. Rolls-Royce operates a flat-rate power-by-the-hour scheme covering all scheduled overhaul and a certain amount

Variation of Hourly Costs				
Sector Distance (st m)	310	415	575	1,280
Flight time (hr : min)	0:45	1:00	1:30	3:00
Fuel consumption (IG/hr)	350	318	274	254
Cost per flying hour (£)				
Airframe labour	3.3	3.3	3.3	3.3
Airframe materials	9.5	9.4	9.2	9.0
Engine overhaul	17.0	17.0	17.0	17.0
Fuel	40.9	37.1	31.7	29.7
Oil	0.7	0.7	0.7	0.7
Landing fees	16.6	12.5	8.3	4.2
Total hourly cost	£88.0	£80.0	£70.2	£63.9
Cost per aircraft-mile	4s 3d	3s 10d	3s 8d	3s 0d

Total Cost Per Flight			
Sector time (hr : min)	1:00	1:00	1:00
Annual utilisation (hr)	500	500	1,000
Sector Distance (st m)	415	415	415
Annual mileage (st m)	207,000	207,000	415,000
Fuel consumption (IG/hr)	318	318	318
Fixed Annual Costs			
Depreciation	74.0	37.1	37.1
Insurance airframe	11.1	5.5	5.5
passenger	2.5	1.3	1.3
Hangarage	7.1	3.3	3.3
Crew	15.0	7.5	7.5
Hourly Cost			
Airframe maintenance	3.3	3.3	3.3
materials	9.4	9.4	9.4
Engines	17.0	17.0	17.0
Fuel	37.1	37.1	37.1
Oil	0.7	0.7	0.7
Landing fees	12.5	12.5	12.5
Total cost per hour	£189.7	£134.7	£134.7
Total cost per mile	9s 6d	6s 6d	6s 6d
Total cost per seat-mile (10 seats)	11.4d	7.8d	7.8d

of unscheduled maintenance and repair. The cost is £8 10s. per hour per engine.

Fuel and Oil Fuel consumption varies between 350 Imp gal/hr average on a short sector of 300 miles or so flown at a high-speed cruise setting, and 250 Imp gal/hr at maximum range on a long-range cruise technique. The fuel price assumed is 2s 4d per Imp gal. Only a very small tax is levied on turbine fuel and so there is no significant reduction on international flights. Oil consumption is a pint per engine per hour.

Landing Fees Including navigation charges, vary considerably from country to country and airport to airport, and further depend on whether it is day or night and sometimes, as in the UK, on the length of the flight. A study figure of £12 10s per landing is assumed.

still retained, are a four-seat Bell 47J and a Westland Widgeon Series 2. In the first six months the Jet Ranger flew 180hr and the target utilisation is 400hr per annum.

It is too early to detail any representative British operating costs for the Jet Ranger, but Major Smith is still prepared to believe that the Agusta-Bell estimates will be close to actual. A fully equipped Jet Ranger delivered and registered in the UK ready to fly away costs £51,000. Typical fixed-costs of operation

Ferranti Ltd, with headquarters in Edinburgh and factories in many parts of Britain, has owned helicopters for communications and equipment development trials for many years. It is one of several British owners of the Agusta-Bell Jet Ranger—a revolutionary new breed of machine which looks set to have a tremendous influence on the business scene. Major R. Smith (below), Ferranti chief helicopter pilot, was interviewed for the accompanying account of helicopter operations



Helicopter Revolution

WHEN THE NEW lightweight high-speed five-seat turbine helicopters finally come through their mechanical teething troubles the world of business will find in them the most useful short-range vehicles since the motor-car. Operationally, they are infinitely superior to all previous light helicopters. Cruising speeds are high enough not to be too badly affected by normal headwinds, the small lightweight engines make for big cabins and more payloads, while stability and control improvements and the development of cheap autostability systems have brought the whole operation to the threshold of single-engined IFR. But, until the Board of Trade is more convinced of the integrity of these simplified autostability devices, and of the engine-cut emergency descent characteristics of the aircraft, there is not much hope of any relaxation of the ban on single-engined helicopter IFR—especially over built-up areas.

One of the most intensive users of business helicopters is the Ferranti company, with factories all over Britain. Their chief helicopter pilot is Major R. Smith; Mr Sebastian de Ferranti is also a keen pilot and frequently flies himself on business. The company has owned a Jet Ranger since last November and is due to get a second very shortly. The previous machines,

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per annum are: depreciation (seven years to 20 per cent: helicopters depreciate more rapidly than fixed-wing aircraft), £6,229; hull and third party insurance (12 per cent value), £6,450; pilot and expenses, £3,500; hangarage and handling, £700; allocation of overheads, £2,200. The total fixed cost is, therefore, £19,169. The direct costs per hour are: fuel and oil (22IG/hr), £2 15s; reserve for engine and airframe parts, £1 5s; reserve for engine overhaul (750hr TBO), £4 16s; reserve for retirement items, £3 2s 6d; maintenance, scheduled and unscheduled (including a 1,200hr overhaul) £1 5s. The total direct costs per hour are £13 3s 6d. Thus, the estimated total operating cost per hour (including 15 per cent interest on the mid-life capital invested) varies from £51 17s 10d at 600hr per annum to £42 12s 9d at 800hr and £37 4s at 1,000hr. The seat-mile cost varies between 11d and 16d on these assumptions—most creditable prices considering that helicopters go from door to door and, unlike fixed-wing aeroplanes, do not put in unproductive miles doing circuits and so forth.

The Ferranti Jet Ranger is not yet fully equipped, but from past experience Major Smith is planning to rely on the Decca Mk 8A hyperbolic navigation system as the primary navigation aid. He has not seen any other system nearly as suitable for helicopter work. The only reservation is that an undistorted chart is essential for locating off-the-beaten-track places. While the total system reliability is not yet 99 per cent the basic receiver is rarely in trouble ("it is only the computer and presentation that goes wrong") and therefore anyone who really understands the equipment is never stuck.

Although operations are VFR and Special VFR day and night, clearances are given in very low conditions of cloud and visibility—the minima for Special VFR into Battersea are 800ft cloud and 800 metres visibility. Major Smith considers that in flying around urban areas it is easier to avoid weather at night because of the shine-through from lights on the ground—they show up the thicker areas of cloud. A big source of night flying worry—what it would be like trying to make an emergency landing—is considered to be largely eliminated by the carrying of two Schermuly flares. The drill would be to shoot off one flare (1min 15sec burning time) to locate an emergency landing spot, and then a second to light up for the actual touch down. Despite the visibility and cloud base minima, not more than five per cent of flights are seriously delayed due to weather.

The most effective radius of action is considered to be on distances of up to 300 miles. The Ferranti Jet Ranger spends a lot of time plying between London and Manchester and the city-centre-to-centre time is 1hr 10min plus or minus only 5min for wind variations. From the factory in Oldham to the Millbank offices in London takes 1hr 20min compared with 3hr 15min by train. The helicopters are available for use by all levels of management within Ferranti. Urgent field services are often carried—spares, and mechanics to fit them, from Bracknell to Fylingdales BMEW station, for instance.

Great progress is being made with the appearance of these new helicopters, but there is still an awful long way to go. Pitifully few local authorities have given any thought to the provision of helicopter landing areas, and it is almost fantastic that there is no established site anywhere near the City of

London's business world. Indeed some moves by the authorities seem almost calculated to hinder the development of helicopter operations—no doubt the first reaction to seeing a small increase in the number of movements. An irritating instance of this is the realignment of the H2 route west from the Battersea Heliport. This seems to have done nothing but add distance and cause radar confusion with approaching traffic into Heathrow. On the other side of London, control has been removed altogether from the north-east and south-east approaches. Now in the steering committee stage of formation is a Helicopter Advisory Board, comprising leading pilots and operators, with the intention of presenting a much stronger rotary-wing lobby.

Light Twin Economics

SEVERAL HUNDRED LIGHT TWINS perform the bulk of the business flying by British companies. To get a feel for these operations—their costs and effectiveness—*Flight* studied six that were typical of many. It was intended to detail costs in each case but, quite reasonably, while virtually every company approached was most keen and helpful to disclose the innermost facts it was apparent that such detail, without rigorous and confidential explanations of *modus operandi*, could be misleading. The costs quoted are, therefore, not exactly those incurred, but adaptations of real figures related to explainable circumstances. The Whitbread and Vickers-Armstrong Aztec operations, the GKN Dove and B.206-S and the *Flight* Baron are the study subjects. Gregory Air Services and McAlpine Aviation, charter operators of Twin Comanches and Aztecs, are reviewed elsewhere in this survey. There follows first a brief account of each operation.

Vickers-Armstrongs Barrow-in-Furness, Lancashire, the shipbuilders of Britain's Polaris submarine fleet, make very considerable use of a Piper Aztec C on flights almost exclusively within the UK. The aircraft provides the remote shipyard town with a fast service to London (Admiralty and company head office), Bath (Admiralty), and shipyards all over Britain and Northern Ireland. Passengers vary from the most senior of company and Admiralty personnel to fitters and technicians being rushed to cope with snags on ships and submarines that during trials may enter port anywhere and anytime in urgent need of attention. Over 3,400 hours have been flown in the last four and a half years.

This utilisation of some 750hr a year is probably the highest of any Aztec. All the flying is performed solo by the company's one full-time professional pilot, Capt Ron Wallbridge, an ex-RAF wartime pilot who took up flying again and got a CPL at 40. The Aztec is based at Vickers' own airfield at Barrow.

GKN is an engineering company of many and widespread interests and with factories located throughout Britain and in many countries on the Continent. The company owns a Dove and a Beagle B.206-S and is still expanding its use of light aircraft; the current estimates are for an annual utilisation of 500hr per aircraft. Inter-factory services over short distances into many of the smaller grass airfields in the UK are the main



Business twins: the "Flight" Baron alongside the Fokker Fellowship at Amsterdam. The operating cost and effectiveness of the Baron is discussed with that of other light twins in the article commencing on this page. Although the Fellowship is primarily a short-range airliner, it is being promoted, like its turboprop predecessor the Friendship, as a medium-range business transport for governments, air forces and large companies

pattern of operation, with occasional trips to France, Ireland and as far afield as Sweden and also, it is expected, to Italy. Coventry is the base. Chief pilot is Capt P. W. M. Mallorie, with a staff of three full-time pilots. All flying is two-crew—an aircraft does not fly if there is only one pilot available. The operation comes under the GKN Group Services Ltd.

Whitbread, the City of London brewers, have made good use of an Aztec since 1961 to give all levels of management rapid communications with the company's brewing, bottling, distribution centres and collaborative partners throughout the British Isles, Belgium, the Netherlands, Denmark and Northern France. The aircraft is based at Biggin Hill and is managed and flown by Capt Roffey, the company's full-time professional pilot. Utilisation is at an average of 400hr per year, but this is expected to increase to over 500hr with the change to a Piper Navajo. Whitbread is getting this bigger and more comfortable aircraft this month.

Flight Baron flying is mainly a self-drive operation by the pilot members of the staff needing to travel, and utilisation has therefore been lower than usual for a business operation. Nevertheless, the cost per hour, on an average of 200hr per year, is competitive. With only two or three staff part-time pilots (editorial duties take precedence) it is difficult to fly more than 250hr a year. The services of a freelance professional pilot are occasionally used in connection with flights for other journals of the group—the Baron does nearly as much flying a year for the *Autocar* and *Motor Cycle* as it does for *Flight* and *Air Cushion Vehicles*. The aircraft is based at Gatwick, and has flown all over Europe: Moscow, Stockholm, Palermo, Madrid and Belfast are the extremities of travel.

Costing a Light Twin Depreciation and the lost interest on capital are the most important cost factors, yet the most difficult to be dogmatic about. In general, most operators find that the taxation allowances on investment, and the annual allowance on capital employed, just about equal a realistic rate of depreciation. Almost any arbitrary write-off rate (to 20 per cent over seven years, for instance) is far more severe than is in fact the case. Light twins have a good record for holding their purchase price for over ten years or more. Interest on capital is very much up to a company's own judgment. *Crew costs* are the other large fixed item. Opinions differ widely on whether one man or two is the satisfactory minimum flight crew. So far as cockpit workload is concerned, even IFR at night in a busy control zone is by no means beyond the capabilities of a good pilot—especially if the aircraft also has an autopilot. The risk with single-pilot operation is simply that of the chances of the pilot being incapacitated one way or another. A salary in the region of £2,500-£3,500 plus expenses is normal for professional pilots of light twins. *Insurance* rates vary between 1.5 per cent and 4.5 per cent for all hull risks and limited third party liability. Most companies get a good quote by including the aircraft in their total industrial insurance cover.

Maintenance costs do not vary much between operators using the larger fixed-base factory-approved organisations around the country. A typical major Check 4 at 1,000hr intervals (or an annual C of A) for the six-seat twins will cost between £800-£1,000 and somewhat more or less according to utilisation and unscheduled failures. The mechanical reliability of the aircraft is generally good, but minor difficulties of all kinds continue to occur to airframes and systems. Engine failures with twins are nothing like as rare as many people imagine. Broken pistons and valves, cracked cylinder heads, exhaust manifolds, generator brackets and throttle linkages happen to all makes far too often. A broken piston, necessitating a premature engine removal, can be a very heavy expense for any private operation, and can fundamentally shake management confidence in the whole operation. For a typical 260 h.p. engine, a total of £2 10s per engine hour is the sort of figure that should be put in reserve against the time-life overhaul. Small reserves should be made for propeller and radio periodic overhaul.

Landing Fees vary considerably, but at major UK airports the charge for a light twin is around £2 5s including navigation



Vickers Armstrongs, the Barrow-in-Furness shipbuilders, get extremely good utilisation and cost-effectiveness from this their second Piper Aztec. Their usage is described in the article beginning on page 958

surcharge. This goes up with night lighting, but there are rebates for short-distance flights and training, and a complete waiver at BAA airports for those landing only to clear customs. Charges abroad vary from the incredibly low at some French airports to the exorbitant at places like Le Bourget and Brussels.

The direct costs of a light twin are around £20 per hour, but when everything is taken into account, the total mounts to between £30 and £35 per hour.

From Private to Public

WHAT BETTER WAY to make your business flying pay off than to expand into air taxi, fixed-base maintenance and aircraft dealership? Surprisingly, McAlpine Aviation of Luton is the only British company so far to have done this. Development is not stopping there. Scheduled services are next on the enterprise—an application is with the ATLB for a service between Southampton and Cherbourg, and plans are in hand for a Swansea-London service, and for other routes in urban areas. The parent civil engineering company now accounts for only some 23 per cent of all McAlpine Aviation flying, but the fleet composition and competitive flying rates reflect an intimate knowledge of the cost-effectiveness of business flying.

The fleet (and hourly rates) comprise: three nine-passenger Rinaldo Piaggio P.166Bs (£45 per hour), two five-passenger Piper Aztec Cs (£35 per hour) and one five-seat single-engined STOL Helio H395 (£20 per hour). The costs are budgeted on a 750hr per annum utilisation per aircraft, although current utilisation is only about 500hr per annum. Two Turbo Twin Comanches are on order for air taxi, and two 16-passenger Piper PA 35 Poconos for scheduled services.

Interviewed by *Flight*, Capt Ray Young, McAlpine Aviation pilot/manager reported that despite the economic squeeze, continental unrest and the foot and mouth epidemic (which restricted flights to Ireland) the company's charter flying had continued the 20 per cent per annum growth of previous years. Industrial companies are the principal clients, but an agency agreement with Thomas Cook, Diners Club, American Express and many ABTA travel agents is expected to open a whole new market to McAlpine. The charter service is 24hr-a-day, every day of the year.

Full AOC proficiency, plus scrupulous attention to fitting the maximum of safety equipment on all aircraft (including full anti-icing protection on all twins), has been the McAlpine password from the start, and has resulted in the highest standard of safety. There are seven staff pilots; the chief is Capt S. Brisk. Minimum experience for any new recruit is 5,000hr total flying and at least 2,500hr in command, of which 1,500hr must have been on twins. These very high requirements are dictated by Pan American and TWA, with whom McAlpine has a through-service agreement. Crewing is also done for privately owned aircraft—first was the Marconi P.166, and others are under negotiation. Mid-continental capitals and the entire UK form the company radius of action.

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**Wider choice
than ever before**



Beechcraft Turbo Baron

Light Twins Flying for business in Britain really took off with the first imports from America ten years ago of the new generation of four-to-six seat light twins. Until then, the only new aircraft available had been the eight-seat semi-airliner de Havilland Dove; the all-wood four-seat Miles Gemini had been out of production for some time and anyway was not really suitable to be fitted with comprehensive electronics for all-weather operation and high utilisation. The Apaches, Aztecs and 310s met a wide-open requirement, and to this day have continued to be by far the most popular class of aircraft used by British companies for business flying.

Light twins subdivide into two sizes, the four/occasionally five- or six-seaters of 160-210 h.p., and the full five/six-seaters of 250-285 h.p. The former are normally four-seaters (including the pilot) but can usually be adapted to take four or five people over short distances by putting extra seats at the back of the cabin where baggage is normally stowed. In this class are the Beechcraft Travel Air, Cessna Skymasters and Piper Twin Comanches. The last is a particularly popular type in Britain, especially with flying training schools, private owners and air taxi companies. The Twin Comanche has come nearer than anything to a Gemini replacement, though many people still foresee a large untapped market for an even smaller and cheaper light twin. The only recent European contender was the Czech Omnipol Morava—a type no longer in production. There are, however, various projects afoot in Britain and

Europe with this requirement in view. Twin-engined versions have been in Beagle's thinking from the very start of design on the single-engined Pup trainer, and practically every similar type on the Continent is being stretched in the same way. But so far all of these are just drawing-board schemes. European enthusiasm for the light twin, and reluctance to make greater use of high-performance singles, perhaps results from the geography of the Continent—largely mountainous in its centre, with a fractured coastline and many islands, making for a considerable number of over-water routes.

The five/six-seater has really hit the business flying jackpot. The Beechcraft Barons, Cessna 310/Skyknight and Piper Aztecs all have the space and power to give reasonably uncramped seating, plenty of room for baggage and a 200 m.p.h. cruise that on stages of up to around 1,000 miles enables them to match the flying times of piston-engined airliners of only a generation ago. Now that the airlines operate jets on most inter-city routes in Britain and Europe, the light twin is hard put to compete on time (and cost if only one or two passengers are to be carried) on flights of more than 400 miles. But that is less than half the story, of course. There are countless towns, cities, industrial areas and resorts that will probably never be properly served by scheduled airlines, and what international services there are between provincial centres operate usually only on a few-times-per-week basis. Against this background, it is easy to see how and why nearly every large company with a travelling management finds business aircraft so useful.

All the light twins can be fully equipped for IFR flying in all weathers. Because of slow approach speeds, and their excellent manoeuvrability, ILS approaches can be continued down to the same weather minima recognised by most airlines—except, of course, those using automatic landing equipment. Furthermore, even when cloud base is as low as 300 ft, there are many instances where light aircraft can be satisfactorily operated into small airfields devoid of electronic approach aids but where these are sited conveniently for nearby beacons.

Single-pilot operation is entirely feasible. With an autopilot some pilots find they can occasionally do as much as six hours' airways flying in a day as well as a day's business. Other "luxury" items of equipment to enhance the smoothness of any light-twin operation, but at a price, include weather radar (for avoiding the severe thunderstorms that often threaten to block the route at light-twin cruising levels), DME (useful for off-airways positioning), and a transponder (which saves frequent position-reporting to ATC). All this equipment can be fitted to light twins.

Turbo-supercharged engines are an alternative powerplant on many types of light twin. The advantages are a higher cruising speed (provided one operates at the most efficient level), an ability to cruise at up to 25,000ft (useful for crossing the highest alp or many a thunderstorm), a higher single-engined ceiling and a useful boost to middle-altitude performance. Against turbo-supercharging is its greater cost, reduced disposable load in most cases, a potential source of unreliability, the inconvenience of having to top-up oxygen reservoirs and the need to wear oxygen masks. Cabin pressurisa-



Cessna Skyknight

Britten-Norman Islander



tion has yet to be proposed for this class of aircraft, but it must be a distinct possibility in the near future.

The only British-made offering in this size, the Britten-Norman Islander, is in a class by itself at present. It does not compete directly with any other light twin of similar power and gross weight. The accent is on maximum seating capacity for minimum seat-mile costs, and the aircraft is of particular interest to short-range air taxi companies. Private owners for whom low-cost high-capacity and a short-field performance are more important considerations than speed and range, will be interested in the Islander's unique qualities.

Medium Twins Business flying was born with this class of aircraft: the de Havilland Dove (no longer in production, but still good value on the secondhand market), Beechcraft 18 and Aero Commander are classics with a long history. The big development in recent years has been the growth of a new generation of aircraft of minimum size for a walk-about interior—i.e. with a side door, an aisle up the middle and a separate flight deck. Cessna was first with the 411. The basic airframe of this type has since been adapted to produce the even cheaper 401 and the pressurised 421. Piper followed with the similar Navajo, and Beechcraft is entering the market with its racy-looking pressurised Duke. Turboprop power is on the cards for all three of these families—though probably not to be on the market before 1970. Britain's only contender is the Beagle B.206-S with a reputation for cabin width, sturdiness and excellent handling qualities. From Continental Europe there is the Rinaldo Piaggio family of P.166s and the STOL Dornier Sky servant. The former is a popular type with passengers because of its high wing and pusher arrangement of the engines—a layout which confers a good view and low noise level. The seaplane heritage (the P.166 was developed from the P.136 amphibian) makes for a strong airframe. The Dornier Sky servant is alone in the class in the same way as the Islander is unique among light twins. Sky servant qualities are aimed at the short-range air taxi operator, and there is a strong accent on short-field performance.

All the comments about operational flexibility and speed



Beagle B.206-S



Beechcraft Duke

competitiveness with airline schedules that were made in referring to the light twins also apply in this class. The medium twins have the same order of cruising speed, airfield performance and manoeuvrability as the smaller twins. Many companies are now graduating into this bracket.

The most important new model to be on the market early next year is the Piper PA-35 Pocono. This 16-seater of 9,500lb gross weight will have two 500 h.p. turbo-supercharged engines and is expected to have very good operating economics on short-haul air taxi, as well as having the speed (retractable undercarriage) and range to appeal to general charter and private users. There is no other directly comparable aircraft.

Light/Medium Turboprops This is the most rapidly expanding class of business aircraft. First in the field, and still by far the most numerous, is the Beechcraft King Air—now well established, reliable and through all its teething troubles. Closest rival is the Aero Commander Turbo II, and the Swearingen Merlin IIB (the latter is not yet being generally promoted within Europe). A size smaller, cheaper and with a short-field performance is the Mitsubishi MU-2F.

At the top end of the bracket competition is thickening. Handley Page was first on the scene with the widely acclaimed Jetstream, which is now well advanced with certification trials and due for customer delivery later this year (ex-Dove operators Clarke Chapman, engineers, of Gateshead, Co Durham, are to be the first with a Jetstream; theirs is due for delivery in October). Similar in size but aimed rather more at the short-range commercial operator are the DHC Twin Otter, Short Skyvan and Beechcraft Model 99—all very good for the private owner with a big lift problem, or for whoever wants a really spacious layout.

The present accent in the turboprop market is on the larger types and this has created a price gap with the piston-engined medium twins. As already mentioned in the section dealing with the latter types, plans are afoot to prepare turboprop versions of the medium twins, such as the Navajo, 421 and Duke. The most promising powerplants are the 317 s.h.p. Allison 250 (presently used only in helicopters) and de-rated versions of the P&W PT6 and AiResearch TPE331. The price range for these new turboprop machines will be £120,000-£150,000 fully equipped.

The turboprops are attracting almost more interest in Britain and Europe than the jets. Most companies flying business air-



Cessna 401

Piper Turbo Navajo



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Handley Page Jetstream



Mitsubishi MU-2F

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Short Skyvan



craft are still feeling their way upwards and have not fully assessed the cost-effectiveness of the exercise to be sufficiently confident to take the big step to jets. The turboprop offers a convenient half-way stage. The aircraft are very competitive with the best airline schedules on flights of up to 1,000 miles or more, and are generally capable of operating into the smaller airfields frequented by general aviation—and that includes many airfields where the only runway is of grass and probably of less than 3,500ft in length. No present jet will look at this kind of field. Turboprop business aircraft offer all the space and comfort of a first-class airline seat plus. Operating altitudes of up to 30,000ft give over-weather-and-mountain performance.

With the medium turboprops one is getting into the semi-sophisticated operating class, and some of the flying techniques adopted for the light and medium piston-engined twins are not so applicable. Sheer size, higher approach speeds and possibly lower manoeuvrability would call for higher weather minima when operating into an airfield without approach aids. ILS minima are, of course, as low as for light twins. In fact some manufacturers have plans for certificating high-precision autopilots for coupled approaches for landings from a manual take-over at Cat 2 weather minima (100ft cloudbase and 1,200ft RVR).

Large Turboprops The only specifically designed business aircraft in this class is the Grumman Gulfstream I of late-1950s vintage. Over 190 of this handsome, popular and very reliable aircraft have been delivered to private and corporate operators. The optional tankage gives intercontinental range, and the navigation installations, cabin arrangements and other equipment standards are appropriate to a global yacht of these proportions. The three other types are adaptations of popular airliners, and their main offering is a large cabin. The airliners are popular with government potentates and other official organisations that habitually travel with a large retinue or what have you. There are unlikely to be any new developments in this class of aircraft.

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North American Aero Commander Turbo II

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LIGHT TWINS (up to 6,000lb gross)

Type	Power	Accommodation Seats (std-opt) Baggage vol (cu ft)	Weights Gross Std empty IFR empty	Fuel Std Opt	Take-off (to 50ft ISA, s.l. g.w.)	Cruise Speed (mph)/ altitude (ft)/fuel consumption (IG/hr)		Payload (lb)— Range (st m)		Price (in UK) Std/IFR equipped £	Remarks
						Max	Long range	Cabin capacity	Full tanks (opt)		
Beechcraft E95 Travel Air	2×180 h.p. Lyc IO-360	4-5 47-29	4,200 2,650*	66 94	1,280	200 7,500	164 11,000	1,000 600	720 1,170	26,300* 33,500	*Includes some electronics
Beechcraft B55 Baron	2×260 h.p. Cont IO-470	4-6 63-28	2,800 5,100 3,075*	94 118	1,255	225 7,000	195 10,000	1,200 750	1,000 1,225	29,391* 36,000	*Includes some electronics
Beechcraft D55 Baron	2×285 h.p. Cont IO-520	4-6 63-28	3,250 5,300 3,075*	94 118	968	230 7,500	195 10,000	1,200 850	1,200 1,143	35,865 46,000	*Includes some electronics
Beechcraft 56-TC Turbo Baron	2×380 h.p. Lyc TIO-541	4-6 63-28	3,250 5,990 3,650*	118 147	1,420	28 290 25,000	18.6 218 25,000	1,200 950	1,130 1,074	46,065 57,000	*Includes some electronics
Britten-Norman Islander	2×260 h.p. Lyc O-540	2-10 166-36	3,800 5,995 3,500*	—	1,010	35 156 6,500	29 150 13,000	1,950 130	1,345 600	27,058 38,000	Fixed u/c. *2-seat all- freight †10-seater (inc pilot's seat)
Cessna 337C Super Skymaster	2×210 h.p. Cont IO-360	4-6 10-5	3,850† 4,400 2,650	77 109	1,545	24 190 6,500	18 150 10,000	1,200 350	940 1,400	22,170 31,865	
Cessna T337C Turbo Super Skymaster	2×210 h.p. Cont TIO-360	4-6 10-5	2,875 4,500 2,795	77 109	1,595	17.5 225 24,000	10.5 169 24,000	1,200 300	695 1,400	25,775 35,461	
Cessna 310N	2×260 h.p. Cont IO-470	4-6 65-40	3,020 5,200 3,125	85 120	1,716	19.0 222 6,500	11.0 179 10,000	1,200 720	965 1,200	31,150 42,205	
Cessna 320F Executive Skyknight	2×285 h.p. Cont TSIO-520	4-6 65-40	3,370 5,300 3,273	85 120	1,513	23.5 260 20,000	15.5 228 25,000	1,200 580	900 1,450	41,158 52,380	
Piper PA-30B Twin Comanche	2×160 h.p. Lyc IO-320	4-6 20-5	3,536 3,600* 2,200	75 100	1,570	25 194 8,000	16.5 175 12,000	1,000 370	563 1,200	18,402 27,000	*3,725lb with opt tip tanks as std on Turbo Comanche
Piper PA-30B Turbo Twin Comanche	2×160 h.p. Lyc TIO-320	4-6 20-5	2,317 3,725 2,408	100 120	1,600	14.5 223 20,000	12.8 181 20,000	1,000 290	340 1,550	23,649 31,000	
Piper PA-23 250 Aztec D	2×250 h.p. Lyc IO-540	6 38	2,520 5,200 2,933	120 —	1,250	14.5 210 4,000	12.8 195 10,000	1,300 800	1,300 1,200	28,788 37,000	
Piper PA-23 250 Turbo Aztec D	2×250 h.p. Lyc IO-540 A/R TC	6 38	3,040 5,200 3,123 3,230	120 —	1,250	28 250 24,000 27.5	17.3 199 24,000 17.1	1,300 850	1,105 1,240	34,788 43,000	

MEDIUM PISTON-ENGINEED TWINS (6,000-10,000lb gross)

Type	Power	Accommodation Seats (std-opt) Baggage vol (cu ft)	Weights Gross Std empty IFR empty	Fuel Std Opt	Take-off (to 50ft ISA, s.l. g.w.)	Cruise Speed (mph)/ altitude (ft)/fuel consumption (IG/hr)		Payload (lb)— Range (st m)		Price (in UK) Std/IFR equipped £	Remarks
						Max	Long range	Cabin capacity	Full tanks (opt)		
Beagle B.206-S	2×340 h.p. Cont GTSIO-520	6-8 34-16	7,500 4,800 5,500	195 —	2,460	225 16,000	185 16,000	1,550* 280	600 1,200	42,500 55,000	*ZFW limited
Beechcraft 60 Duke	2×380 h.p. Lyc TIO-541	4-6 45	6,725 4,100*	117 169	1,660	32 286 23,000	26 210 25,000	1,440 850	1,135 1,175	95,000 105,000	Pressurised (4.6lb/sq in diff). *Includes some electronics
Beechcraft A65 Queen Air	2×340 h.p. Lyc IGSO-480	6-9 26.5	4,300 7,700 4,890*	148 218	1,560	35 214 5,000	29 175 12,000	1,800 600	980 1,400	63,630 79,000	*Includes some electronics
Beechcraft B80A Queen Air	2×380 h.p. Lyc IGSO-540	6-11 26.5	5,150 8,800 5,120*	176 218	1,800	34 229 5,000	25 193 10,000	2,200 770	1,880 1,490	82,000 96,000	*Includes some electronics
Beechcraft 88 Queen Air	2×380 h.p. Lyc IGSO-540	6-10 26.5	5,350 8,800 6,035*	218 —	1,800	46 221 15,000	26 175 15,000	2,200 380	980 1,270	122,150 133,000	Pressurised (3.8lb/sq in diff). *Includes some electronics
Beechcraft Super H18	2×450 h.p. P&W R985	7-11 45	6,250 9,900 5,680	165 265	2,072	35 220 10,000	21 185 10,000	2,200 1,300	2,145 1,700	85,065 95,000	
Cessna 401/402	2×300 h.p. Cont TSIO-520	6-9 60	6,100 6,300 3,641	84 119	2,220	39 240 20,000	27 215 25,000	1,800 600	1,579 1,000	47,958 62,246	
Cessna 411-A	2×340 h.p. Cont GTSIO-520	6-8 60	3,861 6,500 3,865	145 167	2,010	28.5 246 20,000	22 216 25,000	1,600 600	1,075 1,400	54,805 71,521	
Cessna 421	2×375 h.p. Cont GTSIO-520	6 60	4,225 6,800 4,238	145 167	2,516	31 255 20,000	23 226 25,000	1,200 735	923 1,200	74,905 100,732	Pressurised (4.2lb/sq in diff)
Dornier Sky Servant	2×380 h.p. Lyc IGSO-540	2-13 290-80	4,677* 8,050 5,050	200 —	1,100	37.5 200 8,000	27.5 145 12,000	2,800 80	1,560 1,150	85,000 95,000	Fixed u/c. *13-seat version
North American Rockwell Aero Com- mander Shrike	2×290 h.p. Lyc IO-540	4-8 20	4,960 6,750 4,520	130 —	1,375	44 215 10,000	23 195 12,000	1,600 100	855 1,060	50,000 60,000	
NA Aero Comm Grand Courier	2×380 h.p. Lyc IGSO-540	5-11 20	4,960 8,500 5,449	185 233	1,780	23 233 10,000	21 220 16,000	2,200 180	930 1,800	87,500 97,000	
Piper PA-31 Turbo Navajo	2×310 h.p. Lyc TIO-540	6-8 30	5,890 6,500 3,759	158 —	2,270	46 247 23,500	26 181 24,000	1,800 750	1,400 1,550	43,697 55,000	
Rinaldo Piaggio P.166B	2×380 h.p. Lyc IGSO-540	6-10 30	3,950 8,377 5,556 5,750*	185 —	1,800	29.8 222 15,000	16.8 176 15,000	2,000 360	1,297 1,540	66,715 76,715*	*Including high- density seating
Rinaldo Piaggio P.166C	2×380 h.p. Lyc IGSO-540	6-13 30	8,708 5,556 5,780	185 —	1,930	45 222 15,000	160 150 15,000	2,600 150	1,598 1,400	67,000 77,000*	*Including high- density seating

For Abbreviations to Tables: see page 966

BUSINESS AIRCRAFT...

TURBOPROP TWINS (up to 12,500lb gross)

Type	Power	Accommodation Seats (std-opt) Baggage vol (cu ft) Pressurisation diff (lb/sq in)	Weights Gross Landing ZFW IFR empty	Fuel (IG) Std Opt	Take-off (to 50ft ISA, s.l. g.w.)	Cruise speed (mph)/ altitude (ft)/fuel consumption (IG/hr)		Payload (lb)— Range (st. m)		Price (in UK) fully equip and furn'd £	Remarks
						Max	Long range	Cabin capacity	Full tanks		
Beechcraft B90 King Air	2 × 550 e.s.h.p. P&W PT6A-20	7-12 26.5 4.6	9,650 9,168 8,235 5,900	320 —	2,180	256 12,000 65	253 21,000 51	2,400 635	1,345 1,466	218,000	
Beechcraft 99 Airliner	2 × 550 e.s.h.p. P&W PT6A-20	7-17 80-63 —	10,200 10,200 10,200 5,765	307 —	2,025	— — —	250 12,000 65	3,400 300	1,700 1,000	186,000	
de Havilland Canada DHC-6 Twin Otter Series 300	2 × 652 e.s.h.p. P&W PT6A-27	15-21 126 —	12,500 12,300 12,300 6,650	315 —	1,320	204 5,000 68	155 10,000 48	5,000 100	3,250 750	208,000	Fixed u/c
Handley Page HP.137 Jetstream	2 × 850 e.s.h.p. R-R/Turbo Astazou XIV	8-20 50 6.5	12,500 12,500 12,250 8,781*	380 —	2,660	298 15,000 71	240 30,000 46	2,330 745	600 2,020	250,000 Not finalised	*12-seat version luxury furnishing, comprehensive IFR
Helio H-634T Twin Stallion	2 × 317 e.s.h.p. Allison 250-B15	10 — —	5,100 — — 2,845*	100 185	660	205 10,000 42	180 10,000 32	1,650 90	505 700	N/A	Tail-wheel-type fixed u/c; high wing. *basic empty wt. Available late 1968
Mitsubishi MU-2F	2 × 705 e.s.h.p. AIR TPE 331	6-9 30 4.16	9,920 5,790 5,850	302 —	1,700	340 10,000 85	285 20,000 60	1,800 800	1,590 1,550	160,000	
North American Rockwell (Aero Commander) Turbo II	2 × 575 e.s.h.p. AIR TPE 331	6-11 42 4.2	9,400 9,000 8,000 6,000	237 280	1,975	280 10,000 75	270 21,000 55	2,000 350	1,100 1,500	165,000	
Short SC-7 Skyvan	2 × 755 e.s.h.p. AIR TPE 331	2-20 780-30 —	12,500 12,500 12,500 7,650*	290 —	1,530	190 10,000 85	170 10,000 60	4,500 80	2,450 670	165,000	*18-seat version; fixed u/c
Swearingen Merlin IIB	2 × 665 e.s.h.p. AIR TPE 331	8-10 30 7.0	10,062 9,300 8,400 6,500*	321 —	2,200*	295 17,000 70*	270* 27,000* 45*	1,900* 640*	900* 1,785	275,000*	*Estimated from pro- visional data. No UK franchise yet

LIGHT/MEDIUM TWIN TURBOJETS/TURBOFANS

Type	Power	Accommodation Seats (std-opt) Baggage vol (cu ft) Pressurisation diff (lb/sq in)	Weights Gross Landing ZFW IFR empty	Fuel (IG) Std Opt	Take-off (to 50ft ISA, s.l. g.w.)	Cruise speed (mph)/ altitude (ft)/fuel consumption (IG/hr)		Payload (lb)— Range (st. m)		Price (in UK) fully equip and furn'd £	Remarks
						Max	Long range	Cabin capacity	Full tanks		
Dassault Fan Jet Falcon	2 × 4,250lb GE CF700-2D	10-14 43-18 8.2	27,300 25,200 18,960 16,000	1,040 —	4,900	525 31,000 360	465 39,000 230	2,960 1,100	2,750 1,500	650,000	
Hansa HFB 320	2 × 2,850lb GE CJ610-1	9-13 35 8.0	19,400 18,520 14,330 12,500	895 —	5,600	485 25,000 320	425 35,000 200	1,825 980	0 1,650	400,000	
Hawker Siddeley HS.125 Srs 3B-RA	2 × 3,360lb R-R Viper 522	7-12 32 8.36	22,800 20,000 14,200 11,600	1,137 —	3,870	503 31,000 330	449 41,000 200	2,600 1,150	2,100 1,240	370,000	
Israel Aircraft Industries Jet Commander	2 × 2,850lb GE CJ610-1	6-9 16 9.0	17,500 16,800 12,000 10,500	875 —	3,200	525 25,000 320	470 39,000 200	1,500 800	0 1,550	380,000	
Lear Jet Industries Model 24	2 × 2,850lb GE CJ610-4	8-10 40 8.3	13,000 11,880 9,000 6,880	680 —	3,017	535 30,000 325	508 40,000 200	2,000 800	560 1,200	320,000	
Lear Jet Industries Model 25	2 × 2,950lb GE CJ610-6	10-14 40 8.3	15,000 14,000 10,000 7,350	750 —	3,850	527 30,000 355	500 40,000 205	2,650 650	1,500 1,400	390,000	
North American Rockwell Sabreliner Srs 40-8	2 × 3,300lb P&W JT12A-8	10-12 40 8.3	18,650 17,500 12,500 10,250	885 —	3,250	497 30,000 340	460 45,000 200	2,250 700	1,140 1,690	On request	
North American Rockwell Sabreliner Srs 60	2 × 3,300lb P&W JT12A-8	11-14 40 8.3	20,000 17,500 13,250 10,800	885 —	3,900	497 30,000 340	460 45,000 200	2,450 800	1,940 1,690	On request	
Rinaldo Piaggio PD-808	2 × 3,360lb R-R Viper 526	7-11 25 8.3	18,000 12,650 12,500 10,550	840 —	3,350	495 40,000 330	444 40,000 200	1,950 700	550 1,400	400,000	

For Abbreviations to Tables: see page 966

BUSINESS AIRCRAFT...

LARGE TURBOPROPS (over 12,500lb gross weight)

Type	Power	Accommodation Seats (std-opt) Baggage vol (cu ft) Pressurisation diff (lb/sq in)	Weights Gross Landing ZFW IFR empty	Fuel (IG) Std Opt	Take-off (to 50ft ISA, s.l. g.w.)	Cruise speed (mph)/ altitude (ft)/fuel consumption (IG/hr)		Payload (lb)— Range (st m)		Price (in UK) fully equip and furn'd £	Remarks
						Max	Long range	Cabin capacity	Full tanks		
Fokker F.27 Srs 200 Friendship	2 × 2,280 e.s.h.p. R-R Dart 532	14-26 240 5.5	43,500 40,000 37,500 23,800	1,130 1,648	2,820	296 17,000 210	287 25,000 162	13,700 650	5,750 1,950	500,000	
Grumman G-159 Gulfstream I	2 × 2,210, e.s.h.p. R-R Dart 529	24 100 6.5	36,000 34,285 27,370 21,300	1,290 1,490	4,725	350 20,000 165	348 30,000 151	6,070 1,900	2,500 3,100	600,000	
Hawker Siddeley HS.748 Srs 2A	2 × 2,280 e.s.h.p. R-R Dart 532	20-36 340 5.5	44,495 41,500 37,500 27,500*	1,140 1,440	3,010	281 12,000 238	274 20,000 189	10,000 820	4,000 1,850	575,000	*24 seater
NAMC YS-11A	2 × 3,060 e.s.h.p. R-R Dart 542-10	20-60 335 4.12	54,010 52,900 48,500 32,740	1,073 1,541	3,300	297 15,000 315	293 20,000 240	15,750 420	8,570 1,200	650,000	

LARGE TURBOJETS/TURBOFANS

Type	Power	Accommodation Seats (std-opt) Baggage vol (cu ft) Pressurisation diff (lb/sq in)	Weights Gross Landing ZFW IFR empty	Fuel (IG) Std Opt	Take-off (to 35ft ISA, s.l. g.w.)	Cruise speed (mph)/ altitude (ft)/fuel consumption (IG/hr)		Payload (lb)— Range (st m)		Price (in UK) fully equip and furn'd £	Remarks
						Max	Long range	Cabin capacity	Full tanks		
Boeing 737-100E	2 × 15,000lb P&W JT8D-9	20-100 650-280 7.5	111,000 95,000 92,000 55,000	3,890 5,350	7,200	580 22,000 972	485 35,000 550	37,000 850	12,300 3,550	2,000,000	
BAC One-Eleven Srs 400 Executive	2 × 11,400lb R-R Spey 25 Mk 511	20-74 530 7.5	87,000 78,000 71,000 50,650*	3,100 4,100	7,860	528 30,000 650	475 40,000 460	20,350 1,200	4,000 3,520	1,450,000	*20-seat corporate layout
Fokker F.28 Fellowship	2 × 9,850lb R-R Spey Jnr Mk 555-15	14-40 460 6.55	56,700 54,000 46,650 33,090	2,170 2,865	4,000	529 21,000 700	426 25,000 400	13,560 700	200 2,550	1,100,000	
Grumman Gulfstream II	2 × 11,400lb R-R Spey 25 Mk 511	19 160 7.5	58,000 51,430 38,000 34,400	2,770 —	4,400	560 30,000 700	500 40,000 400	3,600 1,950	2,100 3,450	1,200,000	
Lockheed-Georgia JetStar Dash 8	4 × 3,300lb P&W JT12A-8	12-16 76 7.5	42,500 35,000 25,000 22,075	2,210 —	4,800	570 23,000 763	507 37,000 388	2,925 1,100	2,325 2,250	800,000	
McDonnell Douglas DC-9 Srs 20	2 × 15,000lb P&W JT8D-9	20-80 600 7.46	98,000 95,300 84,000 53,731	4,550 —	4,420	582 24,000 980	495 35,000 580	30,000 650	6,770 3,400	1,800,000	

LIGHT HELICOPTERS

Type	Power	Accommodation Seats (std-opt) Baggage vol (std-opt)	Weights Gross Std empty Equipped empty	Fuel (IG) Std Opt	Hover Ceiling (ft) IGE OGE service	Speed(mph)/altitude (ft)/fuel consumption (IG/hr)		Payload (lb)— Range (st.m)†		Price (in UK) Equipped £	Remarks
						Max permitted	Max cruise	Cabin capacity	Full tanks		
Agusta-Bell 206A Jet Ranger	1 × 317 s.h.p. Allison 250-C18	5 20	2,900 1,295 1,550*	63 —	8,800 4,200 18,800	155 3,000	134 s.l.	1,000 240	830 400	51,000*	*Inc inflatable floats, autostabiliser
Brantly B.2B	1 × 180 h.p. Lyc IVO-360	2 6	1,670 1,070 1,140	26 —	6,000 4,550 11,000	85 s.l.	85 s.l.	400 125	340 180	14,500	
Fairchild Hiller FH-1100	1 × 275 s.h.p. Allison 250-C18	5 13	2,750 1,395 1,500*	55 —	13,400 8,400 21,500	127 5,000 19	127 5,000 19	1,000 200	800 360	51,000*	*Inc inflatable floats, autostabiliser
Hughes 300	1 × 180 h.p. Lyc H10-360	3 —	1,670 1,020*	25 40	7,700 5,900 14,000	87 s.l.	87 s.l.	500 145	360 280	17,925*	*Inc VHF com only, and heater
Hughes 500 de luxe	1 × 278 s.h.p. Allison 250-C18	5 —	2,550 1,071 1,310*	59 —	8,600 5,650 13,700	150 s.l.	150 s.l.	825 370	755 440	To be fixed	*No floats incl.
Sud-Aviation Alouette II Astazou	1 × 530 s.h.p. Turb Astazou 2A	5 —	3,640 1,940 2,140*	127 —	5,100 2,950 10,850	127 s.l.	112 s.l.	830 360	460 550	50,500*	*Inc VHF com only, emergency floats, lighting, and gyro instruments
Sud-Aviation Alouette III Artouste	1 × 870 s.h.p. Turb Artouste 3B	7 15	4,630 2,436 2,700*	124 —	6,500 1,800 13,950	130 s.l.	117 s.l.	1,400 160	890 320	80,000*	

For Abbreviations to Tables: see page 966

†No reserve fuel assumed.

BUSINESS AVIATION...

MANUFACTURERS AND AGENTS

Agusta-Bell Giovanni Agusta SpA, 111 Park Street, London W1. Telephone: Grosvenor 2470

Beagle Beagle Aircraft Ltd, Shoreham Airport, Sussex. Telephone: Shoreham 2301

Beechcraft British distributors: Eagle Aircraft Services Ltd, Leavesden Aerodrome, Nr Watford, Herts. Telephone: 01-477 5233

Boeing The Boeing Co, Commercial Airplane Div, PO Box 707, Renton, Washington, 98055, USA

Brantly European distributors: British Executive Air Services Ltd, Kidlington, Oxford. Telephone: Kidlington 4151

Britten-Norman Britten-Norman Ltd, Bembridge Airport, Isle of Wight. Telephone: Bembridge 2511-5

BAC British Aircraft Corporation, Brooklands Road, Weybridge, Surrey. Telephone: Weybridge 45555

Cessna British distributors: Rogers Aviation Ltd (sole full-line dealer in UK), Great Barford, Bedfordshire. Telephone: Bedford 62441. Gregory Air Services Ltd (singles only), Denham Airfield, nr Uxbridge, Middlesex. Telephone: Denham 2417. Northair Aviation Ltd (singles only), PO Box 42, Leeds/Bradford Airport, Yorkshire. Telephone: Rawdon 2251-2. Westair Flying Services Ltd (singles only), Blackpool Airport, Lancashire. Telephone: Blackpool 42660. Aircraft Hire Ltd (training only), C.I. Aero Club, The Airport Jersey, Channel Isles. Telephone: Central 42706. Fair Oaks Aviation Ltd (training only), Fair Oaks Aerodrome, Chobham, Surrey. Telephone: Chobham 7285

Dassault Avions Marcel Dassault, 27 Rue du Professeur Pauchet, 92-Vaucresson, France

de Havilland Canada British Agents: Air Associates Ltd, Page's Yard House, Church Street, London, W4. Telephone: 01-994 1313

Dornier Dornier GmbH, PO Box 317, Friedrichshafen (Bodensee) Germany

Fairchild Hiller British distributors: Helicopter Sales Ltd, 2 Lowndes Street, London SW1. Telephone: 01-235 6477

Fokker Royal Netherlands Aircraft Factories Fokker, PO Box 7600, Schiphol-Zuid, Netherlands

Grumman Grumman Aircraft Engineering Corp, Bethpage, Long Island, New York, USA

Handley Page Handley Page Ltd, Radlett Aerodrome, St Albans, Herts. Telephone: Radlett 4936

Hawker Siddeley Hawker Siddeley Aviation Ltd, Hatfield, Herts. Telephone: Hatfield 2345

Helio British distributors: McAlpine Aviation Ltd, Luton Airport, Beds. Telephone: Luton 24182

HFB Hamburger Flugzeugbau GmbH, Hamburg-Kinkenwerder, Germany

Hughes British distributors: TW Helicopters (UK) Ltd, Cranfield Aerodrome Bedfordshire. Telephone: Cranfield 581

Israel Aircraft Industries Israel Aircraft Industries Ltd, Lod Airport, Israel

Lear Lear Jet Industries Inc, PO Box 1280, Wichita, Kansas 67201, USA

Lockheed Lockheed-Georgia Co, Marietta, Atlanta, Georgia, USA

McDonnell Douglas McDonnell Douglas Corp, Aircraft Division, 3855 Lakewood Boulevard, Long Beach, Calif. 90801, USA

Mitsubishi British distributors: Air Porter Ltd, 2 Basil Street, London SW1. Telephone: Knightsbridge 4438

NAMC Nihon Aeroplane Manufacturing Co Ltd, Toranomon Daiichi Building, No 1 Kotohira-cho, Shiba, Minato-ku, Tokyo, Japan

North American North American Aviation Inc, 1700 East Imperial Highway, El Segundo, Calif, USA

North American Rockwell (Aero Commander) British distributors: Atlantic Commander Ltd, Gatwick Airport, Surrey. Telephone: Crawley 20679

Piper British distributors: CSE Aviation Ltd, Oxford airport, Kidlington, Oxford. Telephone: Kidlington 3931-5. Regional dealers: The London School of Flying, Elstree Aerodrome, Boreham Wood, Herts. Telephone: Elstree 4411. Truman Aviation, Tollerton Airport, Nottingham. Northern Executive Aviation, Manchester Airport. Telephone: Mercury 2870. Rimmer Aviation, Fair Oaks Aerodrome, nr Woking, Surrey. Ballyfree Aviation, Glenealy, Co. Wicklow. Telephone: Wicklow 5607. Michael Gill Aviation Ltd, North East Airport, Woolsington, Newcastle-upon-Tyne. Telephone: Newcastle 869665

Rinaldo Piaggio British distributors: McAlpine Aviation Ltd, Luton Airport, Beds. Telephone: Luton 24182

Short Short Brothers & Harland Ltd, Queen's Island, Belfast, N. Ireland. Telephone: OBE2 58444

Sud-Aviation British distributors: Helicopter Sales Continental, 4 Yeomans Row, London SW3. Telephone: 01-589 6052

Swearingen Swearingen Aircraft, P.O. Box 6904, San Antonio, Texas 78209, USA



Dassault Fan Jet Falcon

BUSINESS AIRCRAFT 1968

Continued from page 962

Light/Medium Turbojets and Turboprops were all the rage three years ago. All the easiest sales have been made to leave a steady, but far less spectacular, demand that at times of economic recession looks dangerously inadequate for the number of contenders. By far the most sales of business jets have been in the US—there are only a handful in countries like Britain, France, Germany and Switzerland. Nevertheless, the manufacturers are optimistic, and there is no doubt that future opportunities for the jet are growing all the time as more and more companies graduate up from medium twins to turboprops. An investment in a jet is far less likely to suffer from depreciation than in many other classes of aircraft. There are no major technical developments on the horizon to make existing aircraft obsolete, and because the typical stage distance is around 1,000 miles, the speed competitiveness in relation to airline schedules is unlikely to change for nearly ten years which is the earliest date that supersonic airliners will be used on stage lengths as short as 1,000 miles.

Lear Jet Model 24



Abbreviations to tables on pages 963-965

Power Abbreviations used: Cont, Continental Motors Corp; Lye, Lycoming; AiR, AiResearch; R-R, Rolls-Royce; Turbo, Turbomeca; P & W, Pratt & Whitney; GE, General Electric. Standard US symbols for piston engines: I, fuel injection; O, opposed cylinder arrangement; G, propshaft gearing; TS, turbosupercharging; V, vertical installation for helicopters; H, helicopter engine.

Accommodation Standard seating and optional total shown respectively, including pilot's seat; baggage volume available appropriate to seating range.

Weights Take-off gross. Standard empty with basic equipment (and seating) as specified by the manufacturer. IFR-equipped weight includes dual VHF com, dual nav (ILS/VOR), one ADF, one marker beacon receiver, autopilot, full blind-flying instruments (including second altimeter), de-icing for airframe and propellers, etc, optional fuel tankage and cabin heating. IFR-equipped pressurised aircraft (piston, turboprop and jet) also include weather radar, ATC transponder and DME in the empty weight.

Performance Take-off distance to 50ft (35ft for turbines) in ISA, sea level conditions at gross weight off a hard runway—best unfactored distance in owner's manual. Cruise speed/altitude/fuel consumption for ISA and optimum altitude conditions. Payload (including pilot)—range, assuming an IFR-equipped aircraft (assuming an equipped empty weight as defined above) in ISA, still air, and with a 45-min holding fuel reserve—max cruising in the capacity payload case, and long-range cruise with full optional tankage. Cabin capacity load assumes all seats filled (total optional seating, 165lb per seat) and baggage bays filled to max permitted weight.

Price Standard and equipped delivered in UK all duty, delivery and certification charges paid. The approximate IFR-equipped price as defined above assuming medium-priced electronic equipment.

BUSINESS AVIATION**BUSINESS AIRCRAFT 1968**

Competition between the Hawker Siddeley HS.125 and the Dassault Fan Jet Falcon (the two fastest-selling jets) has spurred the only major technical developments introduced since business jets came into being. Both these types have been given progressively more power and the permitted operating weights increased. The HS.125 now also has an optional ventral fuel tank, and the Fan Jet Falcon has been given an aerodynamic clean-up. The net result is that both are capable of one-stop coast-coast operation in the US. Further range-growth developments are possible, but it is doubtful whether either will be developed to have full non-stop intercontinental range.

At the lower end of the class in size and price are the Lear Jets and the Jet Commander. Both of these promising machines are just beginning to emerge from manufacturing changes. The former is now backed by Gates Rubber, who have revamped the US distribution organisation, and sales are now beginning to move once again. There has been no further effort to obtain British ARB certification for the Lear Jet, and there is not much likelihood of this as the company does not consider the cost and effort to be worth the comparatively small market. Jet Commander production is being moved to Israel, and it will be a year or so before the type is back on the market for early delivery. The North American Sabreliner, the first medium-weight business jet continues to make solid but little publicised sales progress. Which only leaves to mention two slow starting European entries, the HFB 320 Hansa, and the Rinaldo Piaggio PD-808. Six Hansas have now been sold on the open market, including the first to a US customer, but a German Air Force order is the only big deal in prospect. Similarly, the PD-808 is hanging on an Italian AF contract. An entirely new and most attractive cabin interior for this aircraft by Pinin Farina should considerably enhance the sales prospects, and the chances for setting up a US dealership.

There are rumours of several new jet projects coming along. The interest is in a class and price smaller and cheaper than anything existing. The intention is to fill the price gap between the £250,000 turboprops and the £400,000 jets (prices with full equipment). Two engines under development with this in view are the Pratt & Whitney JT15D turbofan of 2,200lb thrust, and the Snecma M49 Larzac turbofan of 2,300lb thrust. The former is well into development trials and is the subject of a production contract with a leading manufacturer whose identity is a closely guarded secret. The only airframe design disclosed so far is a creation by a Sud-Aviation Nord team. A model of this eight seater called the SN-600 Diplomat was shown at the Hanover Show. Other companies known to be well up with the thinking are Cessna, Piper, Hawker Siddeley and Handley Page. The up and coming Ted Smith Company hopes to fly a jet version of its Aerostar series of mid-wing machines (produced so far only as piston-engine prototypes.)

Operating a business jet has, of course, more in common with the running of a full-scale airline than with the use of piston-engined light-twins that form the backbone of business aviation. The modern jet produces a terrific amount of air transport per annum when utilised to give a respectable operating cost. The effective use of this transport facility by a company requires a quite sizeable administrative effort. So, in addition to at least two pilots and probably an engineer as



North American Rockwell Sabreliner 60

Rinaldo Piaggio PD-808



well, the cost-effective use of a jet by most companies would also involve the work of a full-time administrator. A study of jet operating costs appears on page 956 of this survey. Until the advent of the supersonic airliner, the business jet is more or less fully competitive in its flight times with almost any airline schedule anywhere in the world. The most important exception, probably, is the transatlantic hop, which takes a few hours longer than a direct airline jet flight because of the need to route via Greenland. Business jets can, however, use many small airfields that no jet airliner has yet been designed to go into, and this opens up immense possibilities for rapid connection to some badly served places. Even business jets are, however, generally restricted to hard runways though most of them can be flown off hard dry grassland. Flight equipment can be just about as sophisticated as you can get. Flight systems are the norm, so is weather radar, transponder, and so forth, and occasionally, for the habitual long-distance operator, an inertial navigation platform.

Large Turbojets and Turbofans Here the pattern of the large turboprop market is being repeated with a small difference. Again, Grumman is the sole entrant with a specially designed intercontinental business jet (the Lockheed JetStar is of comparatively medium-range) and the opposition is from converted airliners. But in this case, the airliners have intercontinental range too, and, also, potentially massive cabin capacity. The long-range converted airliners are the Boeing 737-100E, the BAC One-Eleven Executive, and the DC-9 Series 20. The One-Eleven is following in the tradition of the Viscount and is selling well to big corporations, governments and air forces. The Fokker Fellowship, also like its turboprop predecessor the Friendship, is somewhat smaller than the others, of medium range, but with an extremely good airfield performance—the best of any existing short-haul jet airliner.

The Gulfstream II is selling very well (over 90 ordered). It is almost exactly a turbofan version of the Dart-engined predecessor—even the cabin is of almost the same dimensions. Three companies are operating the type, which is beginning to get around as befits an intercontinental business machine.

The greatest technical threat to the market and depreciation considerations of aircraft in this class is the supersonic airliner. Some manufacturers are already giving thought to a supersonic business aircraft, though none has made a serious announcement. One incentive in recent times was the publication by Pan American of a requirement—this was generally considered to be almost beyond the current state of the art in its demands with regard to airfield performance/price/speed and range. Dassault has been reported to have interest in a variable-geometry business jet.

Grumman Gulfstream



BUSINESS AVIATION**BUSINESS AIRCRAFT 1968***Agusta-Bell Jet Ranger**Agusta-Bell 47G-4*

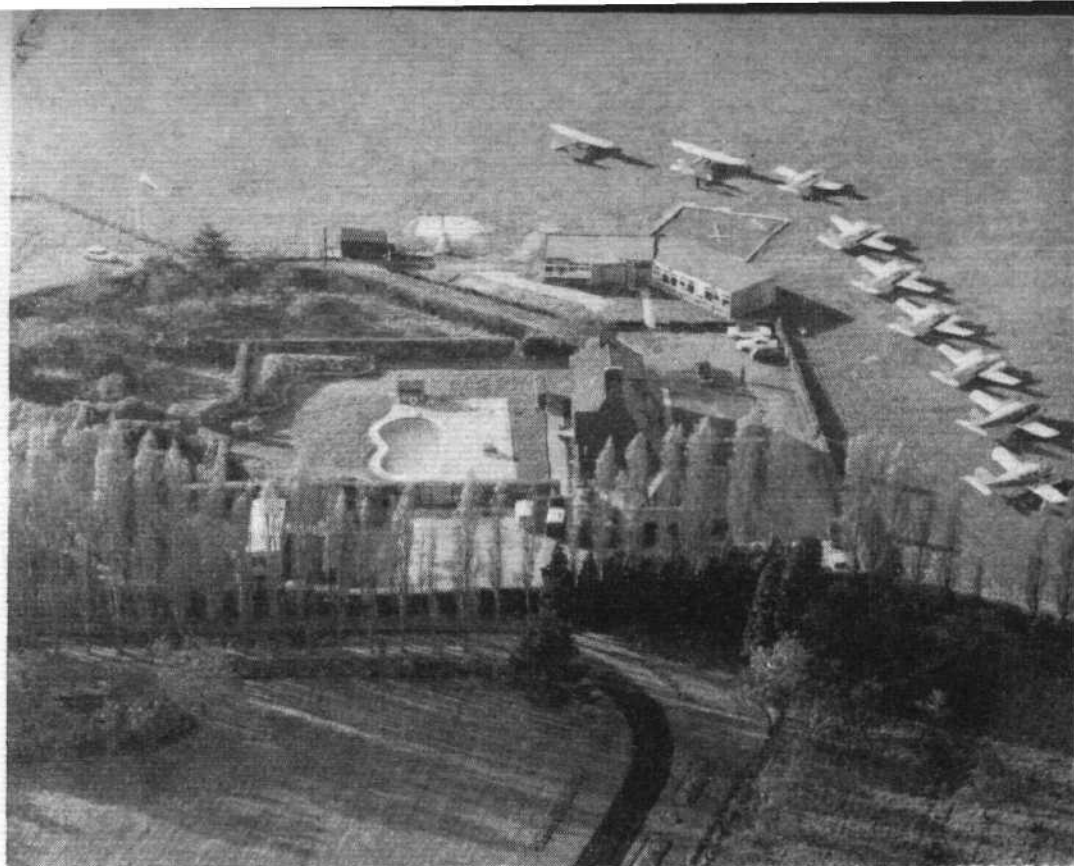
Light Helicopters have only really become a serious and cost-effective means of transport for the business executive with the advent, in the last year or so, of turbine-engined types. Many companies have, of course, made very good use of small piston-engined machines such as the Brantly B.2B and Hughes 269/300, but these operations have really only been practicable under good visibility conditions. A very small payload and slow cruising speed (almost any headwind would drastically reduce range and increase journey time) put a distinct limit on effectiveness. All of these basic objections to the light helicopter are being eliminated; the excellent power/weight ratio of the small turbine, its high rated power and smooth operation have triggered-off a revolution in helicopter design. Single-engined machines such as the Jet Ranger, FH-1100 and 500 will carry five people at cruising speeds approaching those of fixed-wing light twins. It is no surprise that such high-speed, door-to-door performance is by no means cheap to obtain; but its value is beginning to impress a great many companies and the possibilities seem almost unlimited for this type of machine. Operational and cost considerations of this new class of helicopter are described on page 957 of this survey.

The turbines by no means rendered the small piston-engined machine completely obsolete. For short-range flying by one or two people they offer VTOL capability at minimum cost. There are several important new machines of this type not detailed in the data table on page 965. One of these, the American Enstrom F.28A, is to be licence-produced in Britain by Twyford Moors Helicopters (UK) Ltd. This three-seater is powered by a 205 h.p. Lycoming and is expected to sell for

£12,500 with radio (*Flight*, November 2, 1967). SIAI-Marchetti and Silvercraft in Italy are nearing the end of their joint development of the 180 h.p. SH-4 two-seater whose main claim to fame is mechanical simplicity and ease of maintenance. The Bell 47, helicopter classic of all time, continues in production, and the 47G-4 by Agusta-Bell is the private transport version. Several companies in Europe and America are developing new lightweight two-seat helicopters, and it may be expected that the very small turbine will soon revolutionise this class of machine in the same way as it has the three-five seaters.

*Sud-Aviation Alouette III Artouste**Hughes 500*

Gregory Air Services



The Gregory fleet in front of the company offices at Denham. L to r, two Cessna 150s and a Cherokee 140 of the training school, four Twin Comanches and two Aztecs. The Denham Country Club, also administered by Gregory, is conveniently close by

ONE of the most progressive air taxi companies in Britain specialising in the provision of chauffeur-driven aircraft for on-the-spot-hire-and-fly is Gregory Air Services, based at Denham airfield to the west of London. Mr Ken Gregory launched the business five years ago and is still very much the owner-manager. The growth of his company has paralleled the general rise in business aviation activity over the last few years and the financial losses experienced in the formative years have given way to profit.

Gregory offer what is perhaps the widest choice of aircraft of any air taxi company in Britain. Founder types, and still the mainstay of the fleet, are Piper light twins—four 2/3-passenger Twin Comanches and a 4/5-passenger Aztec. For longer distances the company pioneered, and is still alone in offering, business jet charter operations (originally in association with Air Hanson, but now entirely on their own) with a six-passenger HS.125. It is also taking up helicopters with a one-passenger Hughes 269B, and an Alouette II—the latter primarily for TV and cinematography. Gregory also runs an expanding flying school and plans to enter the general aviation insurance brokerage business, to develop the executive jet charter side and expand the sales of single-engined Cessnas, for which he holds an agency. In his first year in aviation Gregory had a turnover of £27,000. By last year the turnover had grown nearly tenfold to £1 million, and in the current year the sights are set at £1½ million.

Radius of Action and Custom Because of a strict specialisation in the private and executive charter market, Gregory sees little chance, for the time being, of operating aircraft of more than seven-passenger capacity. But in the matter of distance he sees no limits. By being based at Denham and Luton (HS.125 only) airfields, both of them close to London, the company is at the hub of an extremely important centre of commerce and international travel.

Having started out in life with Piper light twins it was natural that the business grew largely on medium-range travel out of London and the surrounding area. In the future order of things Ken Gregory sees these aircraft performing best in the 150/400-mile bracket—mainly on UK internal flights and to near-continental points. The light twins have flown much further afield on occasions and will continue to do so for certain missions. But to most points beyond 400 miles from London he believes that scheduled airline fares and timings

are more often than not too competitive for the air taxi light-twin aircraft to show much advantage. Hence his strong belief in the correctness of the executive jet, and why he has two salesmen fully employed on finding new business for his existing HS.125 and the others it is hoped to acquire. At the other end of the range spectrum, Gregory sees another pool of largely untapped potential for rapid transit over small distances under 150 miles. The helicopter is the natural vehicle for this, and the company is getting its feet wet with a Hughes 269 (and the Alouette II) and is planning to introduce a Hughes 500 in February next year. Filming is a valuable source of work for the helicopters and Gregory uses his own design of camera mounting, which has the principal advantage of being quick to set up.

Most of Gregory's passengers today are industrialists, businessmen and government officials. Jockeys, racing drivers and other people in the sporting/entertainment world were the main customers during the company's early days, but they are now a minority travelling group. Gregory is one of a selected number of operators approved for the transport of British Government ministers and top officials.

Average load is about two passengers—hence the primary interest in aircraft of less than seven seats. To most customers of Gregory, time is expensive and the fare is good value. To expand the market just slightly and perhaps get down into the next executive echelon, Gregory plans to operate a written-down seven-seat Dove at a rate per hour hardly more than the 2/3-seat Twin Comanche (both cruise at about the same speed).

Scheduled commuter service possibilities (or third-level airlines as they are known in the US) have been looked at by Gregory at various times and in various places, but he does not believe British conditions are quite right just yet for a boom like that being experienced in the US. The sort of scheduled operation he visualises most easily is the inter-factory service for particular companies in the UK and between UK firms and their European collaborative partners. "A ten-seat HS.125 would have competitive seat-mile economics...."

Selling the services of Gregory Air Services is still the principal occupation of Ken Gregory. "I have a PPL and fly for leisure," he says, "but my place is in the office drumming up business...." How does he sell the air taxi service? "I read newspapers, write letters and do a lot of public relations work; ... satisfied customers spread the word and so it goes

BUSINESS AVIATION

GREGORY AIR SERVICES ...

on." As already mentioned, there are two salesmen working exclusively on the HS.125 with the long-term objective of cornering a large portion of the UK potential for executive jet charter in Gregory's existing aircraft and others that he plans to get in due course. The inter-line agreement which Gregory and others made with BEA earlier this year "has not brought us much business yet," he says; "most people flying into LAP are heading for London. . . . Loganair in Glasgow seem to do best out of BEA."

Costs, Rates and Profits Gregory claims to have scant interest in detailed analyses of fleet costs and utilisation, preferring to rely on instinct for future-policy decisions. So there is little to report in detail on what it costs Gregory to put an aircraft into the sky. One can be fairly sure, however, that the operation is as cost-efficient as any in the business. (A National 32 accounting system is being installed, but results are not yet available.) Gregory has a realistic approach to the question of capital depreciation. He notes, for instance, that aircraft only really begin to depreciate when they become obsolete—



Mr. Ken Gregory, right, chairman of Gregory Air Services, with two of his chief pilots, Capt A. I. J. "Sandy" Burns, jets, and, on the left, Capt Franz Mitterhuber, piston-engined air taxis. Capt Mike Smith, helicopters, was filming in Italy when this photograph was taken for "Flight".

and that only occurs prematurely (an aircraft is normally good for 20-30 years) through the appearance of some technical development in propulsion or other aspect, which can put a more attractive aircraft on to the market. "A six-year old Twin Comanche with several thousand hours on the clock can be sold today for almost the same price it fetched five years ago after just a few hundred hours of flying. . . . An HS.125 Series 1 still fetches more or less its original price and I cannot see this aircraft depreciating for some time to come. . . . Capital and annual tax allowances are a great help to our business. . . ." The company has a small engineering organisation to do all airframe overhauls and regular servicing; only engines, propellers and radio are sent out for overhaul.

A new rate structure philosophy was introduced on May 1 this year. It puts up the price of short journeys but longer trips should be cheaper. The new fare is based on the operating costs implicit in a 660hr p.a. utilisation per aircraft (2hr per day for 300 days). Thus the first two hours per day of each charter are charged at the maximum rate;* thereafter the rate is reduced by up to 30 per cent. Landing fees and handling charges are extra. The latter service is optionally

available at most airports but necessary at LAP. A typical effect of the new rate is that a £20 flight will now cost £23 and a £90 fare is down to £82.

Even a small, slick organisation like Gregory Air Services with headquarters on a simple grass airfield finds that fixed costs are the major part of total running costs and that anything to increase aircraft utilisation has a most beneficial effect on the company's competitive position. Last year the Twin Comanches and the Aztec averaged 400hr each, the HS.125 achieved nearly 600hr (despite being impounded by the Algerians for more than six months), and the training school Cessna singles averaged 800hr each. Targets for this year are 600hr on the light twins, 700hr on the HS.125, 500hr on helicopters and 1,000hr on school aircraft. These targets are currently being achieved.

Before the balance sheet figures began to appear in black, Ken Gregory and his wife (who between them own the company) had sunk over £43,000 into the business. They own all the aircraft except the HS.125, which is on a lease purchase agreement. "It is now a nicely profitable business," says Gregory.

Modus Operandi A small grass airfield without any electronic approach aid might not seem the best place on which to base a 24hr-day 365-days-a-year taxi service. Commenting on this, Ken Gregory said he found Denham excellent for the purpose. He has complete freedom of action the whole year round, has the sole charter rights and is on the doorstep of London Airport. There is a company let-down procedure based on the Garston and London VORs (8 n.m. and 6 n.m. away respectively) which can be used down to a cloud break at 250ft when positioning back to base without passengers, or down to 500ft base and 1,000m visibility with passengers. Prevailing wind is down the longest runway, which is adequate for gross weight take-offs and landings by all the light twins. The grass is well drained. The surface never gets bogged, and when snow occurs cars are driven up and down to flatten the run; snow has never grounded the company at Denham. The HS.125 is based in McAlpine Aviation's hangar at Luton Airport (25 miles by road from Denham) where customs, ATC and bad weather approach equipment are all available round the clock seven days a week.

Gregory invests each of his pilots with a high degree of business responsibility. The 24hr-a-day service relies on at least one pilot being on call at any time outside normal working hours. If a customer rings the headquarters number (Denham 2417) at, say, 3 a.m., the Ansaphone service gives him the home telephone number of the duty pilot, who can arrange the charter on the spot, quote a price, go to the airfield, meet the customer and hand him the trip contract, pre-flight check the duty aircraft (one is always kept fully serviceable and ready to go), check the met and file a flight plan, then finally switch on the runway lighting (controlled by a time switch to go off after 20min, or it can be locked on) and take off. At the end of the trip he collects the customer's money like any other cabbie.

Nine pilots operate the charter service and six of them are qualified on the HS.125. There are also two helicopter pilots and five flying school instructors. There are three "chief pilots": Franz Mitterhuber, light twins; Sandy Burns, HS.125; and Mike Smith, helicopters. Freddy Dunn is director of engineering and he has a staff of 8-10. The company employs a total of 36 including directors and administration.

Safety and Regularity are clearly of paramount importance with an air taxi organisation just as much as with a State airline, yet by the very nature of its off-airway operation into small airfields, often without local navigation aid, it is an inherently more difficult task in many ways. Gregory has an excellent safety and reliability record to look back on and to preserve. Operation of the HS.125 for hire and reward has required compliance with the requirements of an Air Operators' Certificate (AOC). Although the law does not similarly extend to the light twins and helicopters because they

* Maximum rates: Twin Comanche, £26/hr; Aztec, £36/hr; Dove, £30/hr; Hughes, 269B, £25/hr (dual), £23/hr (solo); Alouette, £60/hr; HS.125, £208/hr fully inclusive except for £21 per night stop or £175/hr plus landing and handling fees, and crew expenses.

BUSINESS AVIATION

GREGORY AIR SERVICES . . .



Gregory Air Services HS.125 charter jet, based at Luton Airport

are all under 5,000lb gross weight, nevertheless the company has adopted many of the AOC standards for operation of these aircraft.

The Air Taxi Operators Association (representing a number of British light aircraft charter companies), of which Ken Gregory is chairman, requires that its members operate to AOC standards. The ATOA actually wants the Board of Trade to extend the AOC to cover the public transport operation of all aircraft above 3,000lb. The present official inspection of these "minor public transport operators" is performed at less frequent intervals than for an AOC but covers many of the same points (inspection of logs, duty hours, licensing, provision of charts and so forth) but does not include training standards.

Most of the Gregory pilots are ex-Service, and no one is employed with less than 1,000hr of command experience. Ken Gregory says he has a waiting list of pilots wanting a job and that the turnover of staff is very low. "We take a lot of trouble selecting people in the first instance. We place emphasis not only on flying ability, but also on personality, appearance and on whether the other members of the team like him. There is no age limit, but most pilots are in their mid-thirties or older." The company will pay for an ex-Service pilot to get his instrument rating (with an understanding of a repayment to the company if he wishes to leave at an early date).

Gregory claims a high degree of scheduled reliability. In 18 months of HS.125 operation, the aircraft was late for only one charter, because a special tool had to be made in order to remove an obstinate starter/generator that was time-expired anyway. The light twins have proved incredibly reliable. Check 1s were originally performed every 25hr or 21 days with a Check 2 at 50hr, but this has been extended in the light of experience, to a Check 1 every 14 days or so—nowadays with virtually no snags. Radio troubles are almost non-existent and the company has negotiated for two years between overhauls. All the light twins are fitted with duplicate Narco Mk12 VHF com/nav/ILS, and duplicate Bendix ADF T-12. Spare units are kept for instant replacement. The school aircraft can also be cannibalised for radio equipment if necessary, as they also have Narco Mk12s. The company keeps some £9,000 worth of spares (£5,000 of Piper, £2,000 of Cessna, and £5,000 of helicopter). The light twins carry a small pack of replacement parts wherever they go; this includes a starter/generator, heater igniter, fuel injectors and an ignition harness.

Future Projects seem to grow logically out of the basic needs of Gregory Air Services. By taking over the school (a profit-making venture in its own right), the company not only became the sole operator at Denham but also gained a useful training organisation for line pilots and new recruits together with a low-cost charter service using the single-passenger 150/172s.† Gregory last year took an agency for the Cessna 150 and 172, and this has been extended to the full single-engined Cessna line. Gregory does not think he will go for the full line, including twins. "Rogers Aviation do that very well, and we have a good working arrangement with them. It would be silly for two dealers to spend a lot of time fighting each other for orders when they ought to be out expanding the market."

A big project of Gregory at the moment is to set up an insurance brokerage specialising in general aviation. "In six years of experience with Lloyds I see the need for a service

tailored to the particular requirements of this business. There have been times when I was shocked to find that I was not covered when I thought I was." Gregory hopes to be able to spell out conditions and cover that general aviation wants and understands. He does not claim that his terms will necessarily be any lower, but "a general aviation operator should know what he is getting." He thinks that existing brokers do not spend enough time differentiating between good and bad risks. Gregory has taken to self-insurance of all hull risks.

As already mentioned, Gregory has serious designs on a continued expansion in the executive jet charter business based on the HS.125. The first all-Gregory operated HS.125 (the first was in association with Air Hanson) went into service at the beginning of May. In the first month it did almost 70hr revenue flying. In addition to training, there are many bookings for the next few months and some into next year. Early users included the Commonwealth Secretary, for a flight to Gibraltar, and Board of Trade pilots for training flights. Gregory is full of praise for the HS.125, which is "a delightful aircraft to operate without worry. My pilots idolise it; they would rather take their instrument rating flight tests on the 125 than in the Twin Comanche. We hope and believe that companies who use the HS.125 will profit by the time it can save them, and will become aligned to the aircraft so that in time we could buy and operate on their behalf either as individuals or in collaboration with other companies."

Gregory as Chairman of ATOA Several light aircraft charter operators in Britain‡ have formed a trade club known as the Air Taxi Operators Association. Flight operational safety standards are the main concern of the Association, which requires that all its members operate to the standards of the BoT Air Operators Certificate, even though the law does not necessarily demand it. (The AOC only applies when a company flies aircraft of more than 5,000lb gross weight for hire and reward.) The ATOA is urging the Board of Trade to lower the gross weight limit for AOC compliance down to 3,000lb. In air taxi operations it is clearly all too easy for the "quick buck" company to cut the corners on safety and offer what on the face of it would seem a good value deal.

ATOA members are urged to report instances of unlawful practice and dangerous operation to the BoT. Ken Gregory tells of a recent instance where an aircraft was sent to a nearby airfield to meet a customer and fly him to the north of England, only to find that he had already left in a locally based aircraft. The latter, it transpired, was not public transport approved, nor was the pilot. "That sort of practice must stop," says Gregory, "and ATOA members are encouraged to report such infringements of the law."

On general matters of trade, the ATOA members have no hard-and-fast rules about collaboration or inter-company agreements. They are certainly not over keen at this stage on widespread agreements with travel agents. Most claim they can quite well create enough business.

† Cessna 150, £8 5s/hr; Cessna 172, £10 10s/hr.

‡ Ken Gregory is ATOA chairman; its full-time secretariat is based at Tollerton Airport, Nottingham. Member companies are Gregory Air Services; Loganair; Midfly; Northern Executive Aviation; Polyphoto Air Taxis; Truman Aviation.

INDUSTRY International

SOUTH GERMAN MERGER

The two South German aerospace groups, Bölkow and Messerschmitt, formally announced their decision, on June 11, to merge their interests into a new company to be known as Messerschmitt-Bölkow GmbH. Official seat of the new company will be Munich, though administrative headquarters will be at Ottobrunn, just outside the city.

Chairman of the 15-man board of directors is Professor Willy Messerschmitt, while the three-man board of management is headed by Dipl-Ing Ludwig Bölkow.

As has already been reported on numerous occasions, negotiations between the two groups, both of whom have long been convinced—even without Government pressure—that a merger of their capacities was a logical and necessary step, have been going on for many months. Decisive progress finally came on May 28, when the Bavarian Government announced that it was prepared to acquire, through the Bavarian Reconstruction Finance Board, a 25 per cent interest in the Bölkow Group. This solved the hitherto thorny problem of finding an acceptable percentage basis for the holdings of the two parent groups in the new company. As now proposed, one-third of the capital will be held by Messerschmitt AG, and one-sixth each by Herr Bölkow, The Boeing Company, Nord-Aviation (the latter companies are already shareholders in Bölkow GmbH) and the Bavarian Reconstruction Finance Board. Actual value of the capital is not yet settled but should be in the region of DM40 million (rather over £4 million).

With a total payroll of approximately

12,300 and a combined basic annual turnover of roughly DM524 million (approx £54.5 million), Messerschmitt-Bölkow will be Germany's largest aerospace industrial unit, with a wide variety of research, development and production facilities in South Germany. The next step will be a reorganisation and rationalisation, in the course of which the present wholly owned subsidiaries will cease to exist as independent companies and be transformed into something like operating divisions.

These subsidiaries today are Bölkow-Apparatebau (missile systems and electronics, ballistics research), Entwicklung Süd (a pure development company and hitherto a joint subsidiary of both parent groups), Junkers Flugzeug- und Motorenwerke (space vehicles), Siebelwerke-ATG (light aircraft), Waggon- und Maschinenbau Donauwörth (lightweight road and rail vehicles) and FUS Avionics Inc, New York. Of the two main companies in the parent groups, Bölkow GmbH has a far-flung research and development programme in the field of fixed-wing and rotary-wing aircraft, missiles, rocket engines and satellites, while Messerschmitt Werke-Flugzeug Union Süd has extensive production and maintenance facilities and is active in the logistics field.

In addition, the new company holds a 40 per cent share in Deutsche Airbus GmbH, a 50 per cent share in UVP (the Paris-based sales organisation for Bölkow and Nord-Aviation products), a 33½ per cent share in Leichtflugtechnik Union, Bonn (designers of the LFU 205 all-plastic aircraft shown this year at Hanover), and finally a 12 per cent share

in SETIS (Société Européenne pour l'Etude et l'Intégration des Systèmes Spatiaux).

Meanwhile, the Reconstruction Finance Board has made it plain that it does not expect to maintain its holding in Messerschmitt-Bölkow indefinitely, and there are strong rumours that its one-sixth share may in due course be acquired by Siemens. This would obviously expand the company's technical basis still further.

Since the new organisation is now big enough and versatile enough to handle any normal contracts and take its place among its European competitors, it has high hopes for the future. First, it is now considered certain that design leadership for the NKF (or Advanced Combat Aircraft) will go to Messerschmitt-Bölkow, and the Joint Working Group representing the F-104 consortium is due to move into the EWR premises in Munich on July 1. Once the present merger has officially come into effect, it is expected that the DM30 million (£3 million plus) already earmarked for NKF development, but hitherto blocked, will be released.

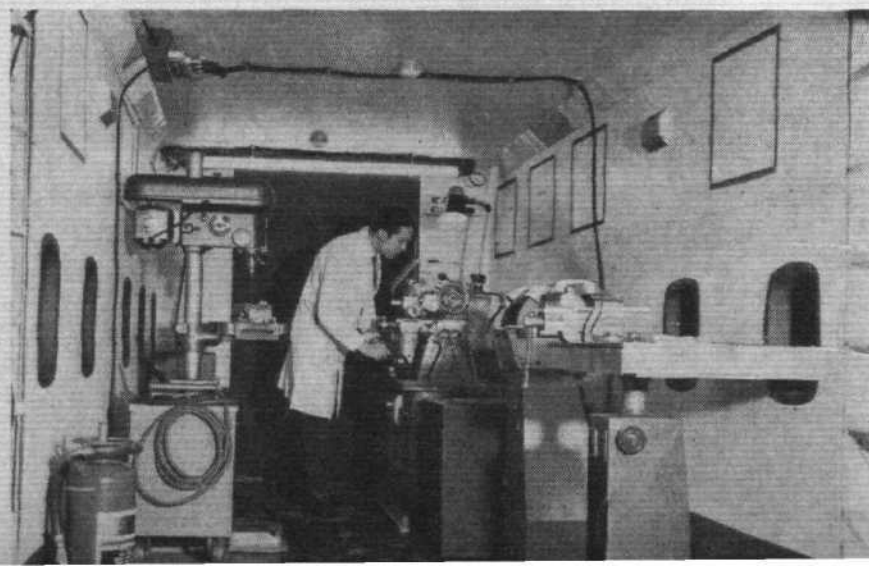
BAC's "Encouraging Years" "I am happy to say that I can now be more optimistic with regard to the future of the industry and specifically the future of British Aircraft Corporation." This is the cheerful view expressed by Viscount Portal of Hungerford in his first public report as chairman of BAC since, in 1965, he issued one called *A Critical Year for the Aircraft Industry*.

Lord Portal says that ensuing events more than justified that forecast; he decided not to make a further report until certain fundamental questions had been resolved. In December 1967 there was a "fundamental overall clarification" of BAC's position. "The Government then stated, after many months of uncertainty, that it would not be possible, for the time being, to proceed with negotiations to implement the policy for the aircraft industry which it had announced the previous year. The directors of the corporation thereupon advised the Government that it was their intention to continue the progressive development of the corporation as a private enterprise company. As can be seen, the forward programme of BAC gives every confidence that this intention will be adequately fulfilled."

Referring to "the shattering blow" the corporation sustained in April 1965 with the TSR.2 cancellation ("at that time BAC had become too dependent upon one key project"), Lord Portal pays tribute to the success of the corporation's sales teams, particularly with Lightnings and One-Elevens. In the three years ending June 1967, BAC had exported products worth over £152 million.

Total group turnover in 1967 was £158 million; on this a trading profit of £7,058,000, before interest and taxation, had been earned. At December 30, 1967, value of the BAC order book was £239,599,000, and orders already received in 1968 totalled £150 million.

With operators of oilfields and remote construction sites in mind, Short Bros have evolved a "flying workshop" scheme for the Skyvan. In this demonstration model the equipment—pallet-mounted for quick change—includes bench, lathe, drilling machine, grinder and arc welder. An APU provides the power. There is room for four operators, and the Skyvan's big rear-loading door is an obvious asset



THE WORLD GLIDING CHAMPIONSHIPS

By A. E. SLATER



Briefing 105 pilots and their crews uses a lot of space and this early-morning event took place each day in a partitioned-off section of a hangar on the airfield. The roof-mounted parachutes are a deterrent to bird marksmanship

This is the second "Flight" special report from Leszno, Poland. The first appeared in last week's (June 20) issue, pages 924-925.

S EVEN CONSECUTIVE DAYS of overcast skies, complete with drizzle, puddles and rain—what a way to start a World Gliding Championship! Three of the seven were in the practice week, one on the opening day, three in the contest period. The Poles said this was unusual in June but not unprecedented, one of them alleging that it had once gone on for a fortnight.

One of the foreigners has suggested a resolution to be put before the next FAI Gliding Commission meeting: that the British should be invited to attend all future Championships but should not be permitted to bring their weather with them. Meanwhile, this temporary rain drain has, we hear, allowed a British pilot to achieve the first 500km triangle in Britain.

At last, on Thursday, June 13, the clag was replaced by fine weather, which had been trying to push in from the north for some days. No one saw it come, but the sun rose into a clear sky, and fine cumulus clouds developed later in the morning.

The task announced at briefing was not too difficult—a race round a triangular course of 224km (139 miles). The Standard Class was launched first, presumably on the assumption that, according to aerodynamic law, sailplanes with a span limited to 15m would take longer to get round than the larger-span machines in the Open Class. Yet in the event the two fastest were in the Standard Class.

First to be launched, at 1101hr, was our own John Williamson in a Dart 15 with Wortmann wing section. The launches were well organised, on the same system as that used by the RAF at South Cerney during the last World Championships in 1965. The tugs here are of Gawron and Wilga type ("W" is pronounced "V"). All 105 machines, 57 in the Standard Class and 48 in the Open, were launched in 1hr 8min.

First across the start line, at 1116, was Thordur Hafidason of Iceland, but he only went 38km and got no points. Next was Ross Reid of New Zealand at 1122 and after him they came over thick and fast—fast because it is an advantage, if one is already higher than the 1,000m maximum for crossing, to dive down on to the line and pull up again. But, although the cumulus had started to build up at 10 a.m., not everyone found it easy to get away, for there were 35 machines circling

in one thermal which happened to be situated near the airfield.

Cloud streets were to be seen here and there. They provide a useful means of cheating the law of optimum possible speeds across country. This optimum speed is calculated on the assumption that you always climb by circling in isolated thermals and drift with the wind while doing so. Consequently you use up much of the subsequent glide in recovering lost ground, and only the remainder is available for making progress in the direction in which you want to go. Cloud streets, on the other hand, provide a belt of lift along which you can travel for miles without losing height. They are ideal for penetrating upwind.

Charlie Yeates of Canada in a Cirrus used them for this purpose and finished third; whereas Dick Johnson of USA, in an HP-14, who found no streets, took half his total time over the first leg in spite of thermal strengths of 2½ or sometimes 3½m/sec and finished tenth.

"Pair flying," by which two pilots co-operate with each other by radio to find thermals, is now forbidden; nevertheless,

Hans-Werner Grosse graphically illustrates a point to Gerhard Waibel (the Schliecher designer responsible for the new ASW-12 glass-fibre sailplane), Wally Wallington and Rika Harwood





Above left, A. J. Smith, who was leading in the Standard Class after the first three competition days. He flies an Elfe S-3 in the American team, and is seen here discussing the prospects with Rika Harwood, associate editor of "Sailplane and Gliding." Above right, Jerzy Smielkiewicz, designer of the Polish Pirat sailplane, talks with Lorne Welch of the British team



The Open Class Kotka IHV-3 which was flown by the Finnish pilot Seppo Hämäläinen

WORLD GLIDING CHAMPIONSHIPS ...

they cannot avoid helping one another when one of them is seen by the other to be climbing.

But does it help? Andrew Smith of USA, in a Swiss Elfe S-3, spent 80 per cent of the time flying in company with Hans Nietlispach of Switzerland, in a Phoebus; they finished third and fourth in the Standard Class with speeds of 76.9 and 74.0 k.p.h. respectively. George Burton of the Open Class, who flew on his own most of the time, achieved a speed between theirs, 75.8 k.p.h., but with an SHK of bigger span.

Hardly had reports of the first successful rounding of the first turning-point come in, when news of a very different nature arrived from the same region. Nicholas Goodhart and several others reported by radio that they had seen a collision between Udo Elke of East Germany and Ziya Aydogan of Turkey, both flying Fokas. One parachute was observed descending, then one Foka was seen on the ground with an open parachute canopy close beside it.

It was several hours before the truth was sorted out. Elke had jumped and opened his parachute at once, with the result that he and his Foka were uncomfortably close together all the way down. His glider's tail and the greater part of one wing had been neatly chopped off. Both he and it descended into a bog; he is reported to have sunk to his waist and to have been extricated without his shoes. Aydogan kept a cool

ILLUSTRATED WITH "FLIGHT" PHOTOGRAPHS

head; he is a flying instructor of much experience, with 900 hours' gliding and (up to now) 74 parachute drops. Seeing what was happening to Elke, he decided to make a delayed drop to 600m before opening up.

Just after 3 p.m. the successful pilots began crossing the finishing line in quick succession, led by Dick Johnson of USA. Comparing their times with a list of start-line crossings, we thought at first that Wroblewski, the present world champion, had won in the Open Class, that George Burton was third, and that both had exceeded 80 k.p.h. But official corrections next day gave the following finalised results for the leading competitors and other British pilots:—

Open Class

Place	Pilot	Country	Sailplane	k.p.h.	Points
1.	Vergani	Italy	Cirrus	77.1	1,000
2.	Wroblewski	Poland	Zefir 4	76.8	991
3.	Yeates	Canada	Cirrus	76.7	988
4.	Schreder	USA	HP-14	76.0	968
5.	Burton	UK	SHK-1	75.8	962
	Schubert	Austria	Diamant	75.8	962
20.	N. Goodhart	UK	HP-14s	70.7	814

Standard Class

Place	Pilot	Country	Sailplane	k.p.h.	Points
1.	Stouffs	Belgium	Libelle	78.0	1,000
2.	Lindner	W Germany	Phoebus A	77.9	997
3.	Smith	USA	Elfe S-3	76.9	974
4.	Nietlispach	Switzerland	Phoebus	74.0	905
5.	Muszczynski	Poland	Foka 45	72.0	858
24.	Williamson	UK	Dart 15W	61.8	617
50.	Innes	UK	Dart 15W	—	136

43 completed the course, 14 did not. Innes made 138km distance.

Friday, June 14 This was to have been another triangular race day with a longer course than before, 313km. But thermals were slow in starting, and as this left insufficient time to get round the triangle, especially in view of the strong wind, the task was changed to a 226km out-and-return. Mr Dankowski, the chief organiser, who was up himself in the "snifter," then ordered by radio that it would be for the Standard Class only and told them when to start.

This contest also proved impossible to all but George Moffat of the USA, who brought in his Swiss Elfe S-3 over the finish-

Rumania, entering the championships for the first time, was represented by two pilots in the Standard Class both flying Foka 4s. The one below is piloted by Mirces Finescu





The new Schleicher ASW-15 has a claimed glide ratio of 38:1 at 46kt and was flown by Hans-Werner Grosse of the West German standard class team

ing line as if leading a pack. But the pack failed to materialise, so the rules did not allow him any points for speed as well as for distance; nevertheless, only his speed, 62.06 k.p.h., enabled him to get back before the thermals gave out and to earn the day's maximum of 588 points.

The thermals were both wide and strong—Williamson found their strength 4-6k—but they gave out rather suddenly. For instance, Moffat had to make a 40km glide to the finish from his last one, and Ian Loughran of India found them good up to and including the last one he could find, 70 miles short of Leszno on the return leg. The Indian team, by the way, consists of that country's four leading pilots, each with all three Diamond qualifications, and they did not decide until the last moment which of the four would fly and leave the others to retrieve.

Leading results include John Williamson this time:—

Place	Pilot	Country	Sailplane	km.	Points
1.	Moffat	USA	Elfe S-3	226	588
2.	Fritz	Austria	St. Austria SH	214	549
3.	Reid	N Zealand	Ka-6E	212	543
	Bloch	Switzerland	Elfe S-3	212	543
6.	Williamson	UK	Dart 15W	205	520
16.	Innes	UK	Dart 15W	187	461

Finalisation of these scores enabled the overall position of the 57 Standard Class entries after two days' flying to be established. Here are some of them:—

STANDARD CLASS: POSITIONS AFTER TWO DAYS

Place	Pilot	Country	Sailplane	Points
1.	Smith	USA	Elfe S-3	1,487
2.	Nietlispach	Switzerland	Phoebus	1,448
3.	Bloch	Switzerland	Elfe S-3	1,380
4.	Moffat	USA	Elfe S-3	1,318
5.	Lindner	W Germany	Phoebus A	1,305
11.	Williamson	UK	Dart 15W	1,175
14.	Reid	N Zealand	Ka-6E	1,106
40.	Fowke	N Zealand	Ka-6E	605
43.	Innes	UK	Dart 15W	597
44.	Mix	Canada	Foka	536
46.	Blackwell	Australia	Foka	458
48.	Loughran	India	Foka	360

Next came two unsuccessful tasks, which nobody completed.

Saturday, June 15

Both Classes flew once more, the Open being launched first this time. They were again given the same task, and though a few forebodings were expressed, there were no collisions. Thursday's affair cannot, in fact, be attributed to there being 105 sailplanes launched on the same task within a little over an hour, because there were only 13 machines in the thermal at the time.

Competitors had the same 224km triangle as on Thursday, but the other way round. Soon a "gaggle" of 15 were in the same thermal. But a most extraordinary inter-gaggle set-to occurred further along the course, according to one informant. A strong thermal containing one lot of sailplanes was pushing

up towards a weak thermal containing another lot higher up. The lower group were circling left-handed and gaining height towards the upper group, who were circling right-handed. As each pilot transferred from the lower to the upper gaggle, he converted his left-hand turn with a dexterous twist into a right-handed one and continued safely upwards among his new companions.

Grosse of West Germany won the task with 157km, the two Poles were equal second, David Innes came 21st with 97km and John Williamson 30th with 94km.

Sunday, June 16

A 313km triangular race was set, with a SE wind of about 11kt blowing against the pilots on the second leg. Thermals were reported distinctly better than yesterday, but nobody has got round. The longest flights were by Persson of Sweden and Reparon of Holland, both of whom landed on the last leg.

Another collision occurred today, but without either pilot having to take to his parachute. E. Schubert of Brazil lost the long nose of his Erupema nearly as far back as the pedals, and landed at once. Ehrat of Switzerland lost nearly half of the right side of his V-tail, but flew on for another 40km.

The forecasters were expecting the anticyclonic weather to give way to thundery conditions before the Championships ended on June 23.

Just as this article was about to be dispatched, aggregate scores for the first three days in the Standard Class were announced. The more interesting ones were:—

STANDARD CLASS POSITIONS AFTER THREE DAYS

Place	Pilot	Country	Sailplane	Points
1.	Smith	USA	Elfe S-3	1,658
2.	Nietlispach	Switzerland	Phoebus	1,604
3.	Bloch	Switzerland	Elfe S-3	1,518
4.	Moffat	USA	Elfe S-3	1,516
5.	Lindner	W Germany	Phoebus A	1,515
15.	Williamson	UK	Dart 15W	1,515
39.	Innes	UK	Dart 15W	797

To be continued

Edward Makula of Poland and his Foka 5, distinguished from its predecessors by having a T-tail



Letters

V/STOL Marketability

SIR,—May I take the opportunity to sound a warning before yet another British "first" squanders the considerable technological lead which it has over the rest of the world?

We all heard the great fanfare which accompanied the appearance of the HS Harrier, but all that has resulted so far is a "Hobson's choice" order from the RAF. This is a unique aircraft, with considerable attributes and without contemporary opposition, so why aren't Hawker Siddeley cornering the world market?

Come on, Hawker Siddeley—Verily/Sell Them Overseas Lavishly.

London WCI

ROBERT POLLARD

How Many Engines?

From Sir Roy Fedden

SIR,—The speed and tempo of development in aeronautics is so rapid and sustained that over-anxiety to learn something from the past while looking at present problems can be tiresome and boring.

Nevertheless I venture to raise this point, having been one of a small group which campaigned between the two world wars for more than two engines in aircraft above a certain size, especially those for civil use. I have therefore been intrigued to read technical articles and recent evaluations advocating only two jet-propulsion units on the latest large airliners. This data seems well founded at first sight but nevertheless familiar and, to my admittedly out-of-date eyes, could be even more specious than 35 or so years ago.

Whereas I gather that modern fan-jet powerplants are of the order of 25 times more powerful and reliable than corresponding piston engines and at the same time have a much better power:weight ratio and overhaul life, I get the impression nevertheless that the protagonists of two units per aircraft have been carried away by the same arguments as of yore, while the same three fundamentals which fogged the issue between the wars could still be the niggers in the woodpile today. I refer to: (1) small items such as overlooked bolts and nuts can jam controls, causing an engine stoppage; (2) relatively small external items such as pipes, rods, etc, can fail from fatigue and cause an engine to be shut down; (3) birds and rubbish can get into the air intake during taxiing, causing failure after the aircraft has become airborne.

People who know tell me that such failures do not occur as often as in the old days and that, purely on the one-engine-inoperative case, there is nothing to worry about on paper since modern civil aircraft are more generously over-engined and cruising conditions are less arduous than in the days of piston engines. Nevertheless, I should not be at all happy carrying 300 people in twin-engined aircraft; in fact, on empirical observation, I suggest that the maximum number should be well under half that figure.

Between the wars the Americans were far more bold with twin engines than we in Europe until that great aeronautical engineer, the late Edward Warner, chairman of ICAO, who was in charge of the first DC-4 prototype, came down strongly in favour of the European views on four engines.

I recall another cliché which said, "never employ a new engine in a new airframe." In these far more complex days I presume this would be untenable, but it

does definitely underline the enormous risk entailed in taking on too much at once in an aircraft project which carries a degree of responsibility inconceivable to the layman.

Bwlch, Brecon

ROY FEDDEN

The Fatal Rule Book

SIR,—The recently published C.A.P. 297 describes the classic (and fatal) accident to an American-registered Beechcraft twin which hit the Sussex Downs near Plumpton in bad weather on January 18, 1967, while on a VFR flight from Nice to Gatwick. A beautifully clear report on a textbook case, it provides an object lesson not only to "private" pilots of modern light aircraft but to the flying world as a whole, and it makes spine-chilling reading. It is my belief that the pilot felt he was forced by the rule book to remain in visual contact with the ground, realised he could not safely continue to do so, tried to retreat—and failed.

The aircraft was fully IFR equipped and its C of A and the pilot's licence were valid in all respects. The R/T transcript showed that on receiving a report of the Gatwick weather, which was bad but not impossibly so, the pilot requested (with hesitation) and received a "special VFR" clearance to the field because his Instrument Rating was technically out of date. In the circumstances prevailing the approach controller did not actually use the key phrase, "to remain clear of cloud and in sight of the surface," but that condition is implied internationally by "special VFR," and the pilot was a stranger to our country.

The report suggests that the pilot's lack of recent instrument-flying practice "might well have been the reason for persisting in his attempt to remain in low-level contact flight when it would have been both prudent and possible to have climbed to a safer altitude." I cannot go along with this. A professional pilot of 1,600 hours' experience who had held an Instrument Rating would not be afraid of entering cloud when radar assistance was available. A much more likely cause of the accident was his strict adherence to the regulations ("It is apparent . . . that he was conscious of the need to avoid infringing any controlled airspace"); he thought he was required to be in visual contact with the ground when he entered the Control Zone, and he correspondingly believed that Gatwick's three excellent IFR approach aids, ASR, PAR and ILS, were not available to him on a special VFR clearance.

This situation is not unusual in the UK today. One obvious moral is that we shouldn't let ourselves get into such a position in the first place. Perhaps, to be really safe, we shouldn't fly at all. But having done so, then—and I shall probably be impeached for saying this—"Instrument Rating or no: get up to a safe height, sort yourself out, ask Air Traffic Control for a radar approach, and worry about the regulations later, on the ground." You may be prosecuted for it, but you may survive.

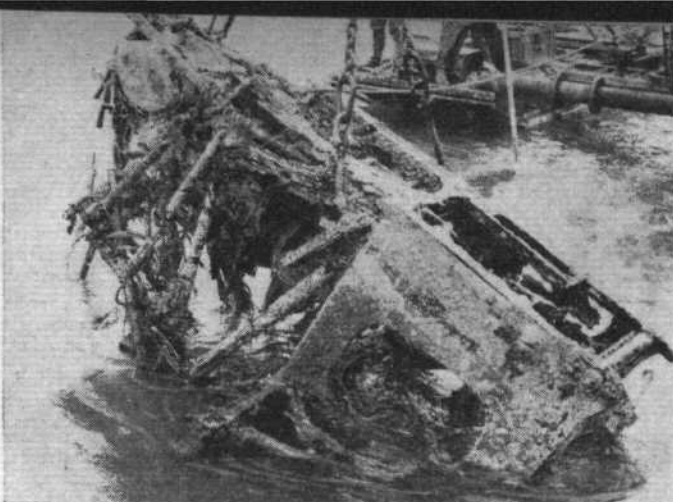
Malvern, Worcs

SCOTT MURRAY, DR

Barnacled Barracuda

SIR,—Recent correspondence in *Flight* on the salvage of wartime military aircraft wrecks prompts me to send the enclosed photographs of a Barracuda [reproduced herewith—Ed] believed to have crashed around 1946-47 a short distance offshore from the village of Highcliffe near Christchurch, Hampshire. It is understood that one of the crew lost his life in the crash, and, indeed, the remnants of a parachute were still to be found in the observer's cockpit.

The engine and mid-section of the fuselage were recovered on June 4 this year by MEXE, a military experimental establishment at Christchurch, Hants, at the request of the local fishermen, who had been damaging their nets on the obstruction for many years.



Recovering a Fairey Barracuda from the sea off Highcliffe village, near Christchurch, Hants (see Mr Wheaton's letter). At left, the engine being brought up; at right, the centre fuselage section is recovered

The aircraft was first lifted from the sea bottom, using divers and a catamaran-type floating pontoon. The pontoon was then driven to Mudeford Quay, when the wreckage was lifted on to the back of an open lorry by crane. As the aircraft was being lifted the engine broke loose and sank to the bottom, but was later recovered.

Although the wreckage was corroded and covered in barnacles much of the wiring and controls were, amazingly, in remarkably good order. As the engine was lowered on to the MEXE lorry it was remarked by one of the local fishermen: "I wouldn't be surprised if they don't get it running within a week."

Bournemouth, Hants

A. P. WHEATON

Abingdon Bouquet—

SIR,—Congratulations to the RAF and to RAF Abingdon for the wonderful display and exhibition which so many of the public were able to attend, in celebration of the fiftieth birthday of the Service. One had been afraid before the event that facilities for the amateur historian and the general public would not be in keeping with the tremendous interest and enthusiasm for RAF history, which the year has produced. For this visitor, at any event, the opposite was the case; and one was reminded of an earlier occasion this year at another (non-Service) establishment, when a press photographer, from his privileged position on the airfield side of the public barrier, was heard to ask "When will the Avro Trip-plane be flying?"

Yes, RAF, you did us proud. What a pity the magnificent Souvenir Book did not include some competition entries among its articles; and speaking of publications, it is to be hoped that someone produces in book form that unique collection of colour drawings of the aircraft in which the VCs of the air were won.

Northampton

NORMAN DAVIDSON

—and Brickbat

SIR,—Having been very impressed with the efficiency with which the RAF presented their history in the static exhibition and flying display at Abingdon on Saturday, June 15, I was correspondingly very disappointed in the Souvenir Book on sale there. After only a cursory inspection (I haven't yet read the text) I was surprised to find several mistakes in the picture captions.

For instance, an obvious FE is entitled a BE.2d, and a BE conversely is called a Henry Farman (and should it not be a Henri Farman anyway?). A D.H. 9 is termed a 9a, and what on earth is a Vickers Victorian? I think the Hawker Demon shown is really a Hind, particularly as the reason for showing it is to mention the fact that the Demon had a power-operated turret, which the aircraft in the picture hasn't.

There are also some more pedantic points, such as calling a Fairey IIF a one-hundred-and-eleven F, and a picture of a BAC/Bregnet Jaguar, not to mention the Harrier approaching a Victor tanker when it has obviously not only approached but has actually attached.

I've no doubt that more experienced aviation

historians will find that I have also "boobed" and that there was in fact a little-known Vickers Victorian and a BE.2d which looked like an FE.2d; but some of my criticisms are, no doubt, correct.

One would have expected the RAF to be experts in their own history and it seems a pity that the attention to detail, so obvious and necessary in the engineering and flying branches of the Service, should be lacking in others.

Hull, Yorks

B. J. WATSON, AFC, AFRAES

B. C. Hucks Recalled

SIR,—I do not suppose I was the only person to view the Abingdon display with regret at the paucity of aircraft of the early days of the RAF—regret coupled with anger at the lack of foresight which permitted the wholesale destruction or sale of scores of Snipes and Dolphins, D.H. 9s and 9As, without setting a representative sample on one side for the benefit of posterity.

Mr Baxter's reference to the mechanical engine starter "put together by RAF boys" on a Model T Ford hid a link with pre-RAF history. The prototype of this starter was made at the Hendon works of the Aircraft Manufacturing Co in the summer of 1918 to the ideas—if not the detailed design—of the firm's chief test pilot, B. C. Hucks. I do not know how many of the starters were produced—we saw them all over the place. In non-Service circles they were known as Huck's starters. They were viewed with mixed feelings. The "ack emmas" loved them but some pilots felt that the starters masked engine failures by making it possible to start engines which were better left unstarted. We heard the opposite view expressed by other pilots—namely that it was a mistake to make engines too reliable, short of complete reliability, as an occasional engine failure kept a pilot in practice for the ultimate failure!

B. C. Hucks was one of the leading flyers at Hendon in 1910-1914, usually in a Bleriot monoplane. He was the first Englishman to loop the loop. Sadly, he died in the influenza epidemic just after the end of the 1914-18 war.

A paragraph in his 1913 souvenir booklet reads: "As the reader can readily imagine, a display of bomb-dropping such as is described above forms a very fascinating adjunct to an already very fascinating flying exhibition." "Very" seems to be the operative word.

Captain (later Sir) Geoffrey de Havilland was of course designer to the Aircraft Manufacturing Co from 1914 to its demise in 1920.

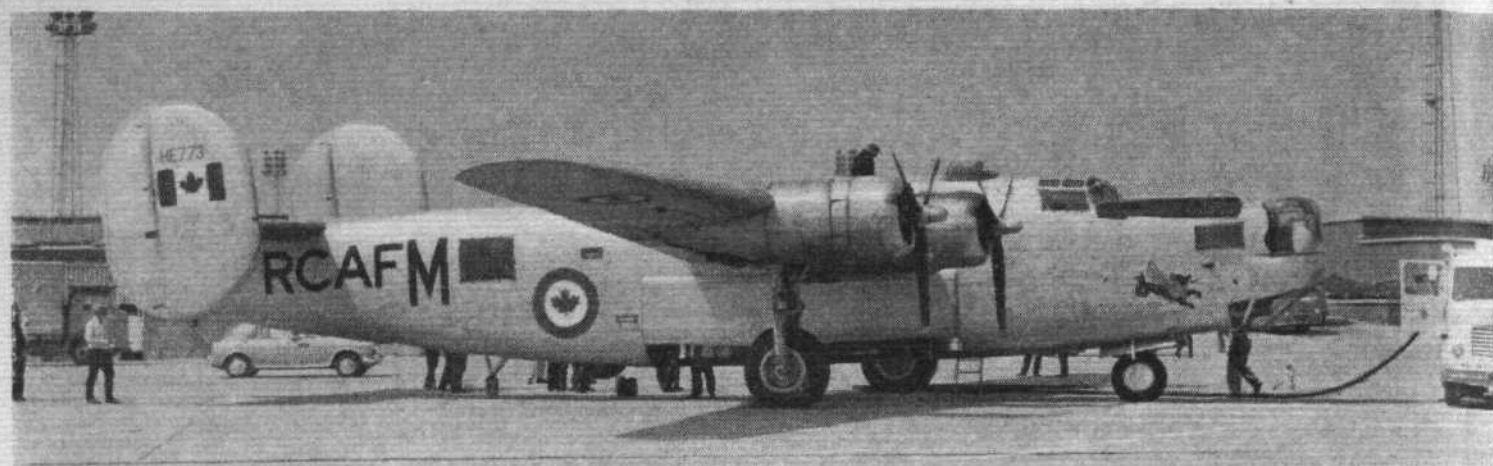
Leamington Spa,
Warwicks

W. KENNETH MACKENZIE

Spitfire LF 16

SIR,—I have been looking, somewhat belatedly I am afraid, at your issue of March 21. In particular the coloured plate of the Spitfire LF 16 caught my eye.

As I was responsible, in the then Ministry of Aircraft Production, for the preparation and publication of the official Air Publications on all the Spitfire and Seafire aircraft, I can claim to know my Spitfires when I see



Ex-Indian Air Force B-24J Liberator in RCAF markings at Prestwick Airport earlier this month on a ferry flight to the RCAF Museum at Rockcliffe, Ont., for preservation. It was operated by 6 (MR) Sqn, IAF, and had been acquired at the end of the Second World War from a large number of RAF-redundant machines. For its Atlantic crossing a Canadian Armed Forces' Argus acted as escort



Mirage G with a mixed audience of civil and aeronautical engineers at a Royal Aeronautical Society meeting in London recently.

M Deplante had beaten the French general strike by arranging, not without difficulty, to fly a private aeroplane to Britain for the lecture. It is, therefore, all the more embarrassing to record that his talk was attended by an audience which filled only some 15 per cent of the Society's lecture hall.

The lecturer began by reviewing the history of the Mirage G project. The Armée de l'Air originally wanted a V/STOL strike fighter and, as a result, the Balzac and Mirage III-V were built and flown. By 1964 Dassault had progressed sufficiently far with the design of the latter to realise that the thrust/weight penalties associated with the then available lift engines would compromise the mixed powerplant V/STOL aircraft to an unacceptable degree. The Armée de l'Air accepted these conclusions but insisted upon its need for a multi-role fighter able to operate from a 2,700ft runway and capable of Mach 2.5.

These requirements could be reconciled by the use of swept, fixed wings with high-lift devices or variable geometry and Dassault accordingly designed and built two prototypes—the Mirage F.2 and the Mirage G—to enable comparative assessments of the two layouts to be made. To keep down the cost the airframes were built as far as possible from common structures and both were powered by single Snecma TF306s (Pratt and Whitney TF30 with Snecma afterburner).

The Mirage G was found to have a better performance at the low and high speed ends of the profile and to be similar to the Mirage F.2 in the middle of the range.

M Deplante paid tribute to the work of Dr Barnes Wallis—knighted this

month—of Vickers for his prosecution of the v.g. idea; to Bell, which had the first such aeroplane (the X-5) flying in 1951; and to Mr John Stack, the noted American engineer responsible for much of the work on v.g. theory. The speaker went on to describe the choices available in the selection of wing pivot position. With pivots mounted on the fuselage, large centre-of-pressure position changes relative to the c.g. occurred because all the effective wing area was outboard of the pivots. This caused large trim forces and thus drag, unless complicated fuel management systems were employed. Moving the pivots outboard into the wing structure decreased the c.g. shift but cut into the effectiveness of the v.g. layout, caused pitch-up problems at low speeds and necessitated a movable glove.

In the Mirage G the wing sweep may be varied between 20° and 70°, the corresponding projected spans being 15m and 7m respectively. Lateral control is obtained by the use of wing spoilers and "tailerons." A large quantity of fuel may be carried in the wings and fuselage and the single, after-burning engine is fed from a bifurcated intake system with a two-position centre-body in each intake. A low tailplane was adopted to minimise interference from the wing.

External flap rails were deleted because they could not be aligned with the flight path except at one wing position. For the same reason, underwing weapon stowage was excluded in favour of carrying the stores in the fuselage, resulting in rather unusual undercarriage retraction geometry.

Many of the problems, naturally enough, centred around the design of the moving wing. Choice of material for the wing pivots to satisfy a design strength requirement of 12,000lb/sq in and the need for easy welding and good fatigue and crack resistance was made by using a maraging steel with 18 per cent nickel and 6 per cent cobalt. The bearing surface itself was required to have mechanical integrity combined with low friction so as to reduce the power (and hence size) of the wing-sweep jacks, and a p.t.f.e.-type material was selected.

Finally, design of the leading-edge glove was complicated by the need to maintain good contact with the wing, thus preserving a smooth contour, both during wing-sweeping and under 3g load (the ultimate load is 12g). The latter figure was a combat requirement, stemming from the need to evade ground or air fire while sweeping the wings for high-speed flight. The wing sweep could be selected at 20°, 30°, 55° and 70°. Inclusion of the three-position (closed, half-open and open) leading-edge slats and double-slotted Fowler flaps was facilitated by the relatively thick-wing, and allows a 125kt approach and 107kt touchdown at 12° angle of attack. Take-off speed is 130kt after an 800ft ground roll.

A brake parachute was fitted to enable the aircraft to be stopped on the runway after a landing with the wings at 70° in the event of a wing-sweep malfunction.

The aircraft flew officially for the first time on November 18 last year (there was an unofficial maiden circuit a month earlier); the wings were swept 70° on the seventh flight and Mach 2.1 was reached shortly after.

The entire programme, which is supported by the French Government, has cost £7 million. A maximum of 150 people were employed on the project, of which 80 were design office personnel.

The discussion was illustrated by an excellent colour film depicting a typical flight sortie. The good field performance was evident and air-to-air scenes over the Mediterranean showed the aircraft from all possible angles and with the wing continually being swept. Dassault is obviously proud of its Mirage G and frequent close-ups of the nose included the legend "Mirage G, Avion à Géométrie Variable."

Although the lecturer made no reference to political aspects of the Mirage G or to its future, it seems quite clear that France now has a European lead of nearly two years in practical v.g. There can be no doubt that for military swing-wing customers in Europe, Dassault must now be an early port of call.

M.W



Classic Rescue

"HE'S THE LUCKIEST MAN ALIVE," said RAF Sqn Ldr John Bullock of French yachtsman Joan de Kat last Thursday night, after a heart-warming rescue from the North Atlantic. M de Kat, a competitor in the *Observer* transatlantic single-handed yacht race, took to a dinghy, without radio, after his trimaran broke up in heavy seas during the night of Monday/Tuesday, June 24/25.

Sqn Ldr Bullock was captain of the RAF Coastal Command Shackleton 2 from Ballykelly which sighted de Kat after he had been adrift for over 60 hours, and which pinpointed his position until he was rescued by a Norwegian merchant ship.

De Kat radioed his distress, as his craft broke up, at 0722hr British time on Tuesday and this message was picked up on the international VHF distress frequency by an eastbound TWA airliner, and relayed to the RAF Northern RCC at Pitreavie Castle, which co-ordinated the major search which followed.

The first Shackleton took off at 0925hr on Tuesday from Ballykelly and Coastal Command mounted 14 Shackleton sorties from this airfield, totalling 186 flying hours, to find de Kat. The USAF rescue service was also involved, with two HC-97 sorties from Keflavik and HC-130 flights from Larjes, in the Azores, and Argentina, in Newfoundland. Two French Aéronavale Atlantique aircraft from Lannibhoué also joined the search.

M de Kat had reported his position, shortly before going off the air and taking to his dinghy, as 54°N 30°W, but he was actually sighted at 53°55'N 23°45'W—some 220 n.m. farther east. Even allowing for easterly drift it would suggest that his original longitude report was well out, optimistically westwards, due perhaps to his being prevented by overcast from getting accurate sextant sightings.

As it happened, his eventual sighting was almost pure chance, since the Shackleton was headed for a designated search area some 145 n.m. farther west. But Sqn Ldr Bullock had ordered all look-out positions to be manned from 200 miles out. At 1815hr UK time, from the nose position, Flt Sgt P. B. Witts suddenly saw a red flare fired abeam but close to the aircraft on the starboard side and at virtually the same moment two other crew members spotted de Kat's dinghy.

Two smoke markers were fired from 1,500ft to mark the spot and the Shackleton descended to drop further markers and a radio buoy. It directly overflew de Kat, who waved, at about 100ft and Lindholme gear, including a nine-man crew dinghy, was dropped. M de Kat was seen to climb into the larger dinghy and, in rapidly failing daylight and while dropping flares, the



Shackletons were in the news last week with the successful rescue of Atlantic yachtsman M Joan de Kat (see adjacent item). WR 972 is probably the only Shackleton 3 without the Phase 3 modification (Viper auxiliary engines). In the new Royal Aircraft Establishment livery of white, grey and blue it is an early prototype and has been used for six years at Farnborough mainly on parachute development work. It has recently tested crew escape 'chutes for Concorde flight-test crews, and has ground-towed the Concorde's drag 'chute. RAF crews from the RAE's experimental flying department operate the aircraft.

Shackleton homed a Norwegian bulk freighter, *Jagona*, to the spot. Some five hours after the first sighting *Jagona* reported the dinghy one mile ahead and shortly afterwards radioed news of de Kat's successful rescue—the pick-up being easy in quite moderate seas.

Jagona is bound for Riga and M de Kat was expected to be landed in Denmark by pilot cutter as we closed for press. His was a rescue which will long be remembered in the annals of Coastal Command. The crew and aircraft involved were from the Air Sea Warfare Development Unit, of which Sqn Ldr Bullock, a navigator, is CO.

ABM System Under Attack

A REDUCTION in US Government spending of \$6,000 million is the price demanded of President Johnson by Congress in agreeing to his request for an all-round 10 per cent increase in taxes. Reluctantly agreeing, the President condemned the congressional move as "blackmail." Washington observers indicate two major programmes—the US supersonic transport and the Sentinel "thin" anti-ballistic missile system—as the most likely areas for economies.

The political assault on the ABM system, a brainchild of the recently departed Secretary of Defence, Mr McNamara, has already begun. On Monday its congressional opponents were attempting to block an initial appropriation of \$615 million (£250 million) for the system, which is designed to protect the continental United States against the threat of a Chinese ICBM system in the 1970s.

Leading the opponents is one-time Air Force Secretary, Senator Stuart Symington, who contends that US domestic needs are more urgent. He has described Sentinel as "a multi-billion-dollar programme to defend America against a possible missile danger which does not exist today and may never exist."

The Secretary of State, Mr Dean Rusk, said last Friday that the US should not delay construction of the Sentinel chain

even if China was behind schedule in development of its ICBM system. It would be serious, he said, to delay the preparation of US ABM capabilities.

Sentinel is based upon two anti-missile missiles, the short-range Sprint and the longer-range Spartan weapons.

New Zealand Helicopter Order

THE ROYAL NEW ZEALAND AIR FORCE will more than double its helicopter force with the purchase of nine Bell UH-1 Iroquois and seven Bell 47 Sioux helicopters, the Prime Minister, Mr Keith Holyoake, announced last week. The helicopter purchase will be financed by the residue of the \$50 million credit advanced by the US Export-Import Bank remaining after the recent A-4F Skyhawk purchase (see *Flight* last week).

Five Iroquois and six Sioux are at present in service with the RNZAF battlefield support unit, 3 Sqn.

RAF SAR Crews Win Top Honours

THE RAF won both individual and team awards at the three-day international rescue helicopter crew competition at Aalborg, Denmark, which ended last Thursday, June 20. Winning crew was led by Flt Sgt F. Ayris. The RAF's second crew won sixth place among the 24 crews from 24 countries competing.

Behind the RAF in the team competition were: 2, USAF; 3, Belgian Air Force; 4, Swedish Navy; 5, RDAF (last year's winner); 6, Royal Navy; 7, RNethAF; 8, RNethN; 9, RDN; 10, Belgian Navy; 11, W German Navy; 12, Swedish Air Force.

It is expected that the RAF, as winner, will be host to next year's competition.

Dassault/Israeli SSM: Clarification

THE RANGE of the Dassault MD660 surface-to-surface missile being developed for Israel, believed to be 500km, was misprinted as 500kt in last week's issue, page 935, to the confusion of some readers. The speed is not at present known to us but it is almost certainly supersonic.

Spaceflight

SOVIET SPACE LINK-UP?

Two satellites were launched by the Soviet Union last week, within four days of each other, into similarly low Earth orbits, and this aroused speculation that another space link-up was being planned, similar to that of Cosmos 186 and 188 in October last year.

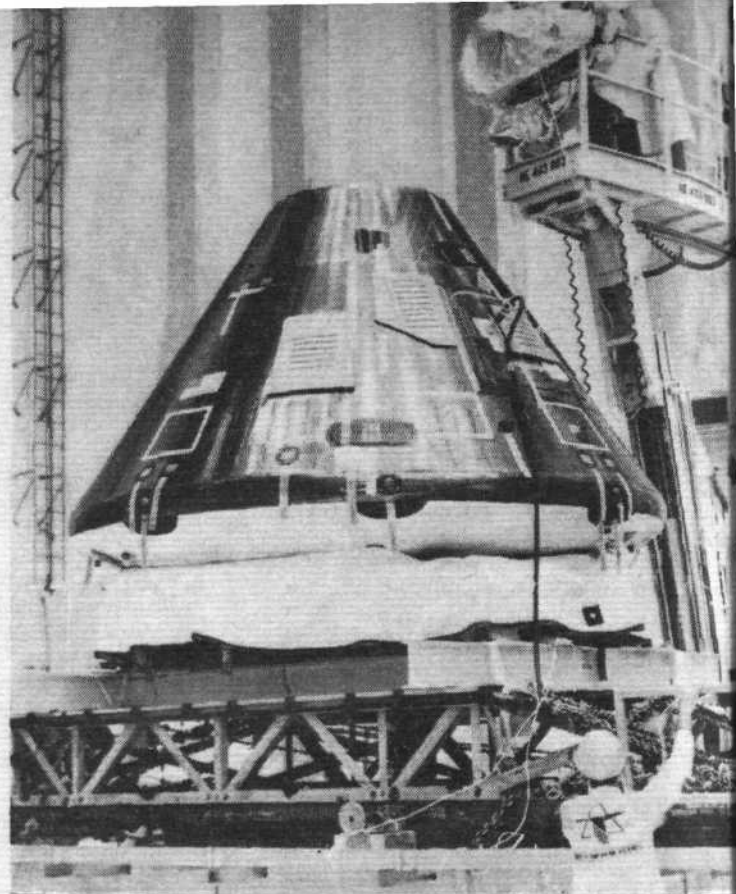
The first of the two, Cosmos 227, was launched on Tuesday, June 18, and had the following orbital parameters: initial period of revolution, 89.2min; apogee, 281km (174½ miles); perigee, 194km (120½ miles); inclination, 51.8°. A United Press report of the launching said that the satellite "flew in an orbit often used by 'spies in the sky' or prototypes for manned spacecraft."

The second of last week's Soviet launchings, on Friday, June 21, was of Cosmos 228, and this had the following orbital parameters: i.p.r., 89min; apogee, 259km (161 miles); perigee, 206km (128 miles); inclination, 51.6°. As can be seen, these were very close to those of 227, suggesting that the satellites were flying near to each other, though there was no official hint that a rendezvous might be intended.

The West German Institute of Satellite and Space Research director, Heinz Kaminski, said that Cosmos 227 stopped sending signals at 0357hr GMT last Saturday, June 22, while Cosmos 228 was following an almost identical orbit. This, he suggested, indicated three possibilities: that the Soviet Union had soft-landed Cosmos 227; that a link-up of 227 and 228 was under way or had been completed; or that both satellites had been put into a "waiting position" for a manned space experiment, possibly the construction of an orbiting space station.



Skylark payload undergoing final checks at the Bristol works Space and Instrumentation Group of BAC Guided Weapons Division (see "Skylark launching," this page). The payload utilises a split nosecone and one half has been removed, showing the X-ray telescope, which has a four sq ft aperture



Command Module 201, for the Apollo-Saturn 205 mission—the first manned Apollo flight—being moved to the workstand at the vehicle assembly building, Kennedy Space Centre, in pre-flight preparations

APOLLO FLIGHT SIMULATION

Three US astronauts undertook a simulated Apollo flight in a space vacuum chamber at the Manned Space Centre, Houston, Texas, last week to prepare the way for the first manned Apollo flight from Cape Kennedy in September. The astronauts, Joe Kerwin, Vance Brand and Joe Engle, entered their cone-shaped craft on Sunday, June 16, wearing the latest white beta-fabric Apollo spacesuits; they had some trouble at the start of the test getting the craft's quick-opening hatch to lock closed; then after they had been inside for about eight hours a leak occurred when engineers were increasing the chamber's "altitude." This was being increased to more than 100 miles (160km), and other tests included subjecting it to temperatures 150° below zero F, and to a 45hr "hot soak," when simulated sunlight would send the outside temperatures up to 150° above zero.

X-RAY STAR SEARCH

"The most powerful yet flown" is how British Aircraft Corporation describes the X-ray telescope of four sq ft aperture which formed the payload of the Skylark space rocket successfully launched from Woomera, South Australia, at 2000hr local time (1030hr BST) on June 12. The rocket had been prepared by the Space and Instrumentation Group at BAC's Bristol works (see picture at left) and the telescope had been designed and built by the X-ray Astronomy Group at Leicester University.

During the flight the telescope made several sweeps across the sky, searching for a new type of X-ray star.

The project is one of a series of Skylark experiments supported by the Science Research Council, which also provides the main funding of the University Research Programme, which currently involves flying experiments on both rockets and satellites for investigations in the new field of X-ray astronomy.

British Aircraft Corporation are main contractors to the Ministry of Technology for the integration and testing of Skylark rockets prepared in the United Kingdom, as well as being design authority and industrial agents.

To date, 183 Skylarks have been launched in the British national and the ESRO programmes, being regularly fired from Woomera, Sardinia and Kiruna in arctic Sweden.

Spaceflight

Britain's Gold-plated Satellite

By G. E. COOK*

This article is a condensed version of a paper, "The X1 and X2 Spacecraft," given by Mr Cook at the British Interplanetary Society annual meeting at Southampton University on April 24/25 ("Flight," May 2). It is published here not only for its intrinsic interest, but because of its relevance to the current Black Arrow launcher programme. The paper is being reproduced in full in "Spaceflight," journal of the BIS, whose headquarters are at 12 Bessborough Gardens, London SW1.

THE SECOND AND THIRD FLIGHT VEHICLES in the Black Arrow development programme will inject into orbit satellites equipped to measure the performance of the apogee motor, the dynamics of separation and environmental conditions. In order to utilise to the full the available payload and space, however, it is intended that these two vehicles should each carry a thin-walled metal sphere for accurate evaluation of air density from the observed orbital perturbations. The main effect of air drag is to retard the satellite every time it makes its closest approach to the Earth, at perigee, so that the satellite does not move out to such a great height at its next apogee. Apogee height is slowly reduced, while perigee height remains nearly constant, so that the orbit contracts and becomes more nearly circular. The rate of contraction, which can be accurately determined, provides a measure of the air density at a height near perigee. By providing suitable surface finishes for the satellites it is also hoped to obtain information on the variation of the drag coefficient with height, as explained later.

Although the entire payload of the first launch is designated X1 and that of the second X2, most of this paper is devoted to the air density satellites.

The basic payloads are essentially cylindrical in shape and house instrumentation for recording payload environment, performance of the third stage motor and dynamics of separation. The instrumentation will probably include (i) one 16g accelerometer; (ii) one 1g accelerometer for determination of thrust tail-off; (iii) four vibration transducers; (iv) one free gyro and four rate gyros; (v) four Sun and three horizon sensors; (vi) a number of resistance thermometers on the structure of the basic payload, satellite separation bay and apogee motor; (vii) a 465 MHz telemetry sender; and (viii) an "L" band transponder for tracking by ground station.

A height of 350km has been selected for perigee of the nominal orbits of both X1 and X2, and the two spheres will be the first satellites launched specifically for determination of upper atmosphere density at this height. The satellites should be particularly useful for investigation of short-term density variations associated with magnetic disturbances and solar activity near sunspot maximum. The high orbital inclination attainable from Woomera will make the satellites suitable for investigation of latitude effects, since the rotation of the major axis caused by the Earth's oblateness will ensure that perigee passes repeatedly through both the auroral zones and polar regions.

At present the least understood feature of the upper atmosphere is the semi-annual variation in density with maxima in April and October and minima in January and July. Recent studies on this subject are somewhat conflicting and further observational data are required before the cause can be isolated with confidence. The Black Arrow air density satellites

should be useful for investigations of this effect, since, for the nominal orbit, perigee will rotate once in about 140 days.

A satellite in orbit experiences free-molecule flow, so that its aerodynamic drag depends on the nature of the interaction between incident gas atoms and the surface. The amount of energy transfer to the surface depends on the ratio μ of the mass of an incident gas atom to the mass of surface atom. Since gold is the only metal which does not chemisorb oxygen, a gold surface should remain almost uncontaminated and ensure a low mass ratio ($\mu \approx 0.08$). If a satellite is gold plated, therefore, comparison of the drag with that of satellites having light surface atoms should indicate whether or not the drag coefficient depends on μ .

Experimental evidence on the effect (or lack of effect) of mass ratio μ on the drag coefficient will improve our knowledge of the Earth's upper atmosphere. At present, atmospheric models are constructed by fitting theoretical diffusion profiles to observational values of density obtained from orbital decay.

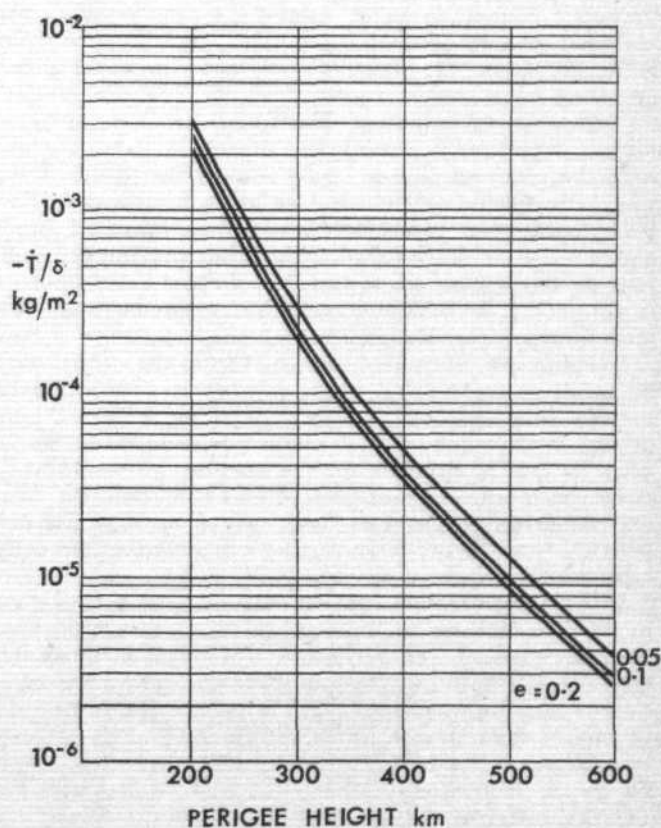


Fig 1

In the original proposal for this experiment, a gold-plated sphere was to be accompanied on the same launch by a second sphere of identical size and weight but with an aluminium surface. Size and weight limitations on the additional payload to accompany the Black Arrow development launchings have unfortunately made it necessary to dispense with the "control" satellite. The satellites will now be launched separately, one with a gold-plated surface by the first vehicle and one with an aluminium surface by the second.

If a satellite is to be used successfully for the investigation of short-term variations in the atmosphere, it must experience sufficient drag. Fig 1 shows the variation of $-T/\delta$ with perigee height for eccentricities of 0.05, 0.1 and 0.2 for a fairly high

*Space Department, Royal Aircraft Establishment.

Spaceflight

level of solar activity, corresponding to a solar flux on a wavelength of 10.7cm of about $160 \times 10^{-22} \text{ W m}^{-2} \text{ Hz}^{-1}$, i.e. the level prevailing in 1960. The values are averaged between day and night. It is essential that the average magnitude of \dot{T} should exceed 10^{-6} if it is to be accurately measurable.

The nominal orbits for both satellites have a perigee height of 350km, an apogee height of 1,874km and are inclined to the equator of $80^\circ.4$. The perigee of the nominal orbit, at the time of injection, is located at latitude $57^\circ.0 \text{ S}$ and longitude $126^\circ.8 \text{ E}$, giving an argument of perigee of $301^\circ.7$. The greatest dispersion from the nominal orbit is expected to arise from the error in the direction of the thrust vector of the apogee stage. Assuming a maximum tip-off error of 5° in the orbital plane, the extreme orbits would have a perigee height of 450km and an apogee height of 1,400km, or a perigee height of 205km and an apogee height of 2,340km. If the same tip-off error occurred in the direction normal to the orbital plane, the inclination would differ from its nominal value by about 2° .

With a diameter of 0.76m (30in), and assuming a mass of 12.7kg (28lb), the area-to-mass ratio is $0.0359 \text{ m}^2/\text{kg}$, giving $\delta \approx 0.079 \text{ m}^2/\text{kg}$ if $C_D \approx 2.2$. For the level of solar activity used in Fig 1, the average magnitude of \dot{T} would be about 7×10^{-6} if the nominal orbit were achieved. The orbital lifetime would then be about three years.

If we were to rely on optical tracking alone, visibility would probably dictate a rather narrow launch window, perhaps $\pm \frac{1}{2}$ hour on any particular day. Since such a narrow window is unacceptable, the satellite will carry a tracking beacon, operating on a frequency near 136 MHz. The beacon will have an unmodulated output of 50mW and be powered by a 12V battery supply with a minimum life of 21 days. To interfere with the outer surface as little as possible, the feasibility of using the sphere as an aerial is being investigated. For this purpose the two hemispheres would be insulated from one another and suitably fed. Results from preliminary radiation tests on this system are favourable. Further development work is continuing on radiation pattern measurement and on the feed system before design of the flight installation is finalised.

Geophysical information obtained from the orbital data will be much more valuable if the satellite is observed both frequently and accurately, with errors of the order of 1 minute of arc in direction and 10 milliseconds in time. To obtain accurate orbital elements for the satellite, we would like good coverage in latitude, with observations from both the Northern and Southern hemispheres, and also good coverage in time, with the gaps between successive observations not exceeding eight hours.

If useful information is to be obtained over extended periods of time, so that the satellites can be fully utilised, tracking will ultimately have to be performed by optical methods. Optical tracking will be most effective if we can secure the co-operation of tracking stations in other countries. The British network of optical stations will also be utilised, but their geographical distribution is less satisfactory and the faintness of the satellite at apogee (magnitude 9) will also cause difficulties. Possible British sources of optical observations are the Hewitt cameras (accurate to 2in of arc) at Evesham and Edinburgh; the theodolite stations, which are, at present, situated at Edinburgh, Malta and Cape Town; and visual observations.

Use of a satellite for air density studies imposes certain design requirements. First, it should have a well-defined area-to-mass ratio; i.e. be basically a sphere with the area of protuberances kept to a minimum. Second, it should have the largest cross-sectional area consistent with the restrictions imposed by the launch vehicle, both to increase drag and to assist optical observations. Third, its weight should be as low as possible consistent with structural requirements.

To conform to these, the satellite is being constructed as a thin-walled sphere with a diameter of 30in. It consists of two hemispheres, spun from 20 SWG aluminium, which are held together by two thin-walled aluminium tubes 2.8in in diameter (see Fig 2). These tubes support at the centre of gravity of

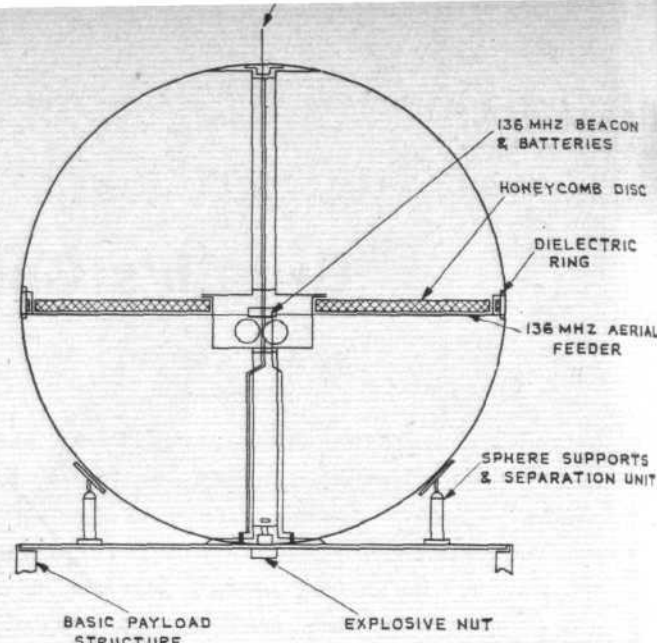


Fig 2 Diagrammatic illustration of construction of air density satellite

the vehicle a canister containing the tracking beacon and power supplies. The two hemispheres are separated by an insulating ring 30in in diameter and $\frac{1}{2}$ in wide. This ring is attached to the periphery of a 29 $\frac{1}{2}$ in diameter aluminium honeycomb sandwich plate which is machined to accommodate the canister. Screws are used to attach the edges of the hemispheres to a lip section of the insulating ring.

The outer surfaces of the satellites will be machined so that surface irregularities are limited to 20-50 micro-inches. For the X1, the final surface finish will be obtained by depositing at least 0.0002in of hard shiny gold on to a nickel substrate. To ensure that the gold surface is as clean as possible at injection, the satellite will be protected after the final cleaning until shortly before launch. X2 will be identical except that its surface will be left as aluminium. Thermal control will be achieved by having white spots evenly distributed over the surface in a polka-dot pattern. The painted area will be kept to a minimum by allowing the beacon and battery pack to operate at its maximum working temperature.

ESRANGE LAUNCHINGS

Two Centaure rockets were successfully launched by ESRO recently from its Kiruna range in northern Sweden. The first, fired on June 7, carried payload C42/2 to an altitude of 131km (81 $\frac{1}{2}$ miles), telemetry signals being received for 13min; the second, fired on June 8, carried payload C32/2 to an altitude of 135m (nearly 84 miles). The payloads, which were recovered, included equipment for the detection and collection of micrometeorite particles. "This," says ESRO, "appears to have worked most satisfactorily."

ASTRONAUTICAL ENCYCLOPAEDIA

Spaceflight has developed a language of its own; words like apogee and perigee, retrorocket, injection and docking, have either been evolved to describe phases of spaceflight or have gained new meanings as a result of it. This new space language, complex and unique, demands dictionaries of its own for all those using it or wanting to learn it. One valuable recent contribution to this demand is a volume in the famous Larousse series, the *Collins Concise Encyclopaedia of Astronautics* (Collins, 14 St James's Place, London SW1; illustrated, 12s 6d, or 18s in a special library edition). Edited by M. Thomas de Galiana and translated into English by Dr A. E. Roy, senior lecturer in the Department of Astronomy at the University of Glasgow, it provides, in words and pictures, an exceptionally useful reference book for everyman in the space age, a vade-mecum for the earth-bound but spatially orientated layman.

H.W.



Straight and Level



THIS WEEK I can reveal that the European Blunderbus has not been cancelled. It is not yet even in the project cancellation phase, and will not be until completion of the cancellation feasibility study.

This phase will be initiated just as soon as the Cancellations Directorate of the Minestrone of Planes can phase up to it.

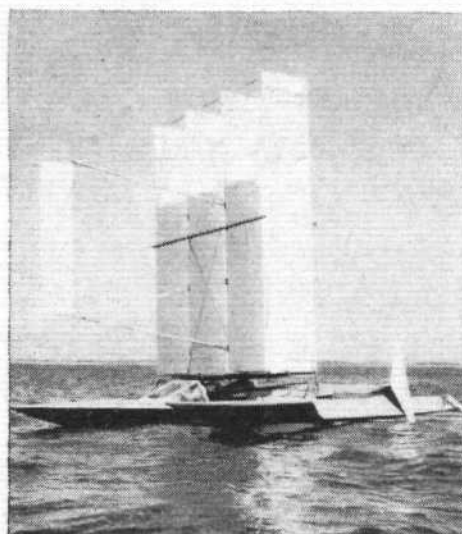
● Come aboard the Scruggs Noo Technology Airplane, folks. It's British (actually it's French, but we can't get them on the phone these days), and if we're going to sell this thing we gotta speak English—right Mac?

How about that stereo boarding music? Just put your coat in the hide-away coat closet here, and your duty-free liquor in the personalised hard-object stowage right there, and adjust your polarised window to the right light density. Hungry? Gourmet dining just coming up on food carts from the underfloor service centre.

Ready for landing? Remember—this is a fail-operational airplane. It's airport-compatible, too. And it's a good-citizen airplane. You crashed? Okay, this plane is backed by Scruggs's World-wide Total Support Systems Concept. A worthy successor in every way to Scruggs's world-famous family of globe-girdling go-birds.

● All six of Europe's busiest routes—I mean the ones carrying more than 1 million passengers a year—are under 400 miles in length. They are London-Paris (1.1 million), Berlin-Frankfurt, Berlin-Hanover, London-Glasgow, Berlin-Hamburg, and London-Dublin.

Who says that the A-300 is too short-haul? Three of the four busiest routes in the USA are less than 400 miles. So



What an interesting looking craft. I must do a tight turn over it at once in my Bristol Boxkite. ("Planesail 1," the first successful rigid-sail yacht, during trials in Chichester Harbour. The aerofoil sails are moulded in Fibreglass, and control is by V-foils under the trimaran hull)

are many of the world's other busiest routes—Tokyo-Osaka, Rio-Sao Paulo, Sydney-Melbourne, Montreal-Toronto.

Who needs a 3,000-mile airbus for these routes? Why not an A-300 with 250 seats, a 500-mile maximum payload-range, and two RB.211s?

● A large part of British Eagle's profit last year, observes the Air Transport Licensing Board with a sniff, came from the sale of aircraft.

What's wrong with that? If you can amortise your aircraft to a residual value that makes you a profit, that's good busi-

ness judgment—unless you haven't got any aeroplanes left to carry on your business with. Since British Eagle are operating a 707-320C on charter to MEA, presumably because they can't get work for it in Britain, I assume that doesn't apply.

From the "Irish Independent"

I see that Pan American have just sold some of their DC-8s for £1.5 million each. Which is pretty well the price they paid for them 10 years ago.

Straight and Level: The Next Ten Years
EACH WEEK for the next ten years Straight and Level will be devoting its entire space to tearing apart, paragraph by paragraph, the recent decision of the Air Transport Licensing Board in the North Atlantic case, exposing it for what it is—the most defeatist, wet, flabby, inconsistent and milksop decision in the history of British air transport licensing, which is saying something.

On second thoughts ten years isn't long enough. Let's forget it, and the board, as quickly as possible.

Roger Bacon

Sorry, sir—we're booked up. Can you come back...

... in about 42 years' time?



Don't think that's D.H.60 Cirrus Moth G-EBLV at Stag Lane in 1926, but it just could be. That certainly is 'LV' at Hatfield in 1968



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Nine Piper Apache 160s—All have four seats, Public Transport C of A and full airline radio stations. The aircraft are being sold with engines at half life. All the Apaches have had top-class maintenance. Two immediately available, the further nine from August 1968. **£7,750**

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Piper Aztec A. Red and white. Built 1961. Fully approved for instrument rating Tests. Public Transport C of A till March 1969. Engines only half-lived. Full de-icing. Autopilot. Radio station includes Dual Arc ADF's Dual VOR's, Narco and Collins. Marker Beacons. VHF I. Collins 680 Channel VHF II Narco MK. 12. Sperry CLO Gyrocompass with integral dual pointer, R.M.I. installation displaying ADF I and ADF II, or VOR signals All radio equipment class I. A superbly equipped twin for only **£9,950**

DH Dove Executive—Six passenger seats, wash basin, toilet. White exterior, blue/grey interior. Public Transport C of A. Full airframe and propeller de-icing. Auxiliary fuel tank. Full airways radio including Decca in excellent order, an ideal company aircraft at only **£12,000**

Piper Comanche B. Only flown 300 hours since new and is immaculate. Exterior colour, white, red and black. Interior, black and biscuit. De Luxe interior trim. Full dual controls and blind flying panel. Rotating Beacon, Piper Altimatic II autopilot. Radio station: VHF I Narco 12A. VHF/VOR/ILS. VHF II. Narco MK. 12A VHF/VOR/Bendix ADF. Markers. **Price £13,000**

Piper Cherokee 140—Built 1965. Two seats. Red and white. Current two-year Club C of A till October 1969. Full dual controls and blind flying panel. Narco Mk. 12 360 channel VHF/VOR. Engine TSO 1020. Very well maintained. **£4,250**

Auster 5 J1. Silver and red. 3 seats. Private C of A till July 1970. Engine TSO 388. Full dual controls. A.S.I. Altimeter and turn and slip instruments. Glider Towing Hook. **Price £949**

Auster Mk 6A—Built 1961. 3 seats. Dual controls. Starter and battery. Club C of A until May 1969. Engine TSO 420. **£949**

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